

QI WORLD



**Program
of the Month:**
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LIGHTNING

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All round art

Four 3-D drawing
packages

Review:

Morse code trainer

DIY Toolkit:

Deadly Sins Part 2

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NEXT MONTH

QL Emulator

Ron Massey investigates the new QL emulator for the Atari ST.

DIY Toolkit

Simon Goodwin looks into pipes and sees the light.

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KEYBOARDS

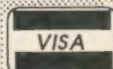
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QL

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Enter stage right

Adventure Creation Tool Special Edition is a greatly-enhanced development of Adventure Programming Tool, reviewed in *QL World*, August 1987, formerly expected to be published by Shadow Games and is now in the hands of Digital Precision.

DP stresses that APT is a software tool which can be used to develop all kinds of applications, not exclusively adventure-style games. "ACT takes all of the drudgery out of producing software which involves inter-related graphics — static multi-frame or animated — and/or text output," it says, and recommends on-screen animation, simulations, real-time event control and psychological analysis as possibilities.

The flexible architecture of APT includes up to 96K of messages, 32K of message groups with up to 1.5K characters each, up to 4K words of vocabulary, up to 256 locations and 256 objects. The number of flags and controls is limited only by the available RAM.

Text formatting is automatic and there is a full-feature sound editor. The two screen modes can be mixed on one screen and the graphics screen is user-redefinable in a program.

The graphics system can be used as a stand-alone program and includes a screen dump. SuperBasic graphics routines can be generated for use in other programs and animation of these pictures is supported.

The features in ACT are accessible from outside the program. On-line

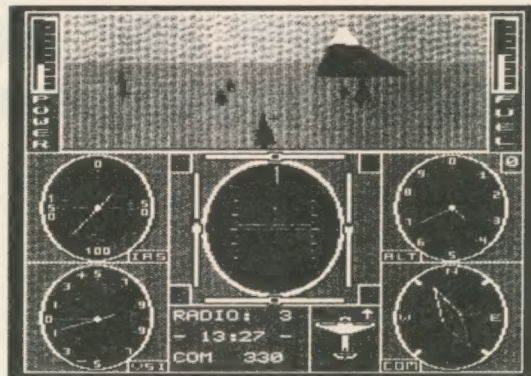
debugging is available, allowing manipulation of the adventure while running it; analytical tools for examining different components of generated programs are provided.

DP states firmly that no programming knowledge is needed to use ACT but that programmers doubtless will find uses for the package of which DP has not yet thought. A full DP-style manual, tutorial and adventure framework are provided and the complete adventure *Imagine*,

reviewed in *QL World*, February 1988, are included in the price of £49.95.

DP says: "ACT Special Edition puts The Quill back into the time when people used quills 100 years ago." Whether ACT and its users will be capable of producing adventures on the scale of *The Faerie Queen* or *The Lord of the Rings* has yet to be seen but the program specification is certainly impressive.

Digital Precision, 222 The Avenue, Chingford, London E4 9SE.



A game for the QL called *The Simulator* has been announced by Ekotek Datasystems of the Netherlands. It is a flight simulator with the characteristics of "an imaginary light aircraft". Ekotek stresses that its program is for fun, not for pilot training.

Some of the features named are realistic cockpit instruments, a four-directional view of the outside world in black and white or full colour; three difficulty levels; reports on flight times, total distance, fuel consumption and other parameters; and different

Chocks away

environments loadable from Microdrive or disc, each with up to five runways and various orientation guides.

Release is scheduled for September and the recommended retail price will be £15. Later in the year Microdrives with five extra environments will be available for around £7.50.

Ekotek Datasystems, PO Box 140, 7570 AC Oldenzaal, Netherlands.

Small traders

SD Microsystems has announced the next software package in its *Small Trader* series. *QL Mail Merger* is designed to allow records to be selected from inside the program *Mailing List* and merged with a standard letter prepared on Quill.

The program allows the name, address and certain details on a standard letter to be altered automatically by the computer for printing-out. A de-luxe version of the *Small Traders' Mailing List* is included, with the utilities section expanded to feature a mail-merge routine with three choices of record selection; scanning the whole file and selecting details with a key-press; choosing all records within a single sort code or merging an entire file.

Once records are selected a data file is generated and a utility imports both the mail data and a Quill list-file for merging. The document is screen-reviewable, with special markers to indicate when the data items should be located. An optional feature allows a personalised note in each letter. Additionally, an extra line of information from the Notes field can be exported with the data. The system is Epson-compatible. Prices are £14.95 including an A4 manual and UK post and packing or £9.95 to current *Small Traders' Pack* owners. Add £1 extra for overseas post and packing.

SD Microsystems
PO Box 24,
Hitchin, Herts.

The heat is off

The Q-Power switching regulator is a miniature printed circuit board assembly which replaces the 7805 regulator and heatsink just behind the Microdrives in the QL. The standard unit is a frequent cause of crashing, memory corruption, Microdrive read/write failures and inoperative networking.

Some users substitute larger regulators but this can overload the external

power supply, causing Microdrive read failures, display shimmering and power supply failure.

The Q-Power has been developed to cure the problem completely, causing virtually no heat output inside the QL — a very easy life for the external power supply even with full memory expansion and disc drives.

To fit the unit, unplug and discard the existing

regulator and heatsink and plug in the Q-Power board. It works by very high frequency transistor switching to deliver exactly the required power. This means no wasted power to turn into heat and very precise voltage regulation irrespective of the load.

For more information contact PC Power Computing, Garfield House, 44a Stanley Street, Bedford MK41 7RW. Tel: 0234 52207.

Compware has enhanced the QL Expert System Shell with a set of upgrades which include forward chaining for higher deductive powers, reporting from all rule types and new reporting features, eight new keywords including freeze, home, warning, error, explain, remember, forget and set, reserved goals and other features.

A new product which

complements the Expert System Shell includes stand-alone versions of the rule-based editor and evaluation programs, somewhat smaller than the original integrated versions but allowing larger rule

bases to be constructed, and also allows commercial distribution of a rule base under a licence purchased from Compware.

The new packages are priced £49.95 (QL Expert v1.1), £20 (Run-time QL Expert) and £50 (commercial licence to market rule bases based on Run-time). Further information from Compware, 57 Repton Drive, Haslington, Crewe CW1 1SA. Tel: 0270 582301.

New enhanced Expert

Apology

CST has contacted QL World to tell us that the late arrival of the Thor XVI at the Thor International press launch was the result of a car crash en route. Fortunately, nobody was hurt.

The QL World representative and those of our immediate colleagues were not aware of the mishap.

QL World would like to make it clear that the tone of its editorial comment last month was the result of continuing disquiet about the development of the Thor XVI, not of one minor mishap.

"We have more people and will be able to get back to customers promptly now, which was not happening before," says a CST representative.

QL World wishes CST a speedy resolution to any problems arising from the shunt.

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ZITASOFT Software By Steve Jones

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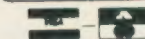
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Thor TIMES



No. 880915

CST IN MOSCOW FOR DIALOG

The conclusion of months of negotiations was achieved in Moscow last month when Thor International signed an agreement with the Soviet-American Joint Venture, "SP Dialog". In

addition to marketing the Thor XVI in the Soviet Union, a range of topics were agreed including the setting up of a cooperative Development Centre for training and support, and plans for promoting the student exchange between Moscow, Cambridge and Copenhagen Universities.

The meeting in Moscow was requested by Piotr Zrelow, General Director of SP Dialog, who had met with the heads of CST and Dansoft in Copenhagen after seeing detailed reports submitted to present the case for using the Thor XVI in the Soviet Union.

As well as discussing the Thor XVI with technical staff from Dialog, the system was demonstrated to Professor Kopolev, Head of Computer Science at Moscow University, and members of his Department. A member of the Soviet Academy of Science, Prof. Kopolev said that the Thor XVI suited the modern approach of 'Perestroika (Restructuring)' compared with more traditional PCs, which were more appropriate for the preceding 'Period of Stability'.



Oliver and Stuen signing agreement with DIALOG staff

KEEP YOUR THOR ON A LEASE!

Thor computers can now be purchased on lease terms. CST partner, Penny Oliver, claims that leasing a Thor can be the most effective way to gain access to computer resources without straining the finite cash flow of your business (or your personal bank account!).

Another advantage to business users is the potential tax saving. Should upgrades be required later, these may be incorporated into the lease agreement.

The cost of leasing a computer over a 3 year term starts from as little as £32.50 per month (including VAT) according to Penny. For details of the various leases available and rates, contact CST.

PERSONAL

WEDDINGS

All the staff at CST would like to take this opportunity to send their best wishes to David Oliver and Penny (formerly Tzatzaris), who were married on the Eighth of the Eighth Nineteen Eighty Eight.

This must be a classic example of being married to your work as Penny had joined David as a partner in the business on the 1st of May this year.

Congratulations and the best of luck to both of you from everyone at CST and all the associated companies!

MESSAGES

Simon N.G. Thx for the Rave Review in CS. CST.

Desperately Seeking Hellmuth Much loved Great Dane last seen in Copenhagen. Come home, we miss you. TI.

The Thor XVI Range:—

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Thor XVI W20FF (20Mb Winchester, 2 Floppies)	£1749.00	£1766.00
Thor XVI W40F (40Mb Winchester, 1 Floppy)	£2369.00	£2316.00
Thor XVI W40FF (40Mb Winchester, 2 Floppies)	£2484.00	£2426.00
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Speedscreen Rom For The Thor / XVI	£29.90	£27.00
Rom Installation On Your Thor / XVI	£15.00	
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OPEN CHANNEL

Open Channel is where you have the opportunity to voice your opinions in *Sinclair QL World*. Whether you want to ask for help with a technical problem, provide somebody

with the answer, or just sound off about something which bothers you, write to: Open Channel, Sinclair QL World, Greencoat House, Francis Street, London SW1P 1DG.

House style

May I add my weight to the Open Channel correspondence about jargon?

I thought it might be amusing and informative if you were to test your contributors with the following, to see how they get on with interpretation of jargon from another trade.

Extract from SMM, 1987
01. Ex to red 1 ne 1500 from fm 250 below ogl, ret part e.m. rem c.a.
02. S&F to ext s.w.gds 1no 2ce reb, spl, rdd & grvd w.bd, with 2no eq rets.

No prizes offered but I

assure you these are totally meaningful to those who use them regularly.

One can always identify the best journalists by their use of plain words. They never forget that they are writing for others, not for themselves.

Maurice Pickering,
Stanmore,
Middlesex.

Talking points

The QL seems to have a reputation for being a computer for those who seek more interesting things than games-playing. Here are three suggestions and I am writ-

ing to enquire whether anyone has done anything like these on the QL, or possibly show a few ideas.

The first relates to an article in *Electronics and wireless World*, January 1988, page 75, called Who Wants a Human Computer? It describes how work has been done in the U.S. on simulating "neural networks" on computers. Although such networks can calculate, they are said to be bad at arithmetic and disinclined to explain their reasoning. Also their screens are said to display random doodles when no information is being input but they sound as if they could interest QL users wanting to experiment.

The second related to the *Mozart* dice game, where random minuets can be composed by a computer. Westhill Music of Aberdeenshire has advertising a program which composes more modern music but it is restricted to the Amstrad CPC range. Is there anything like it for the QL?

A third which springs to mind is based in a recent book *Engines of Creation* by K. Eric Drexler. It provides the idea that machines can be made using individual atoms and molecules as working parts. Apparently in the U.S. "molecular modelling" programs are available, enabling users to design molecules on a computer. Presumably the computer must contain a vast amount of information on what is possible and what is not.

Finally, does anyone know how to use the parallel port in the Super Q

Board direct, without going through Qdos?

John dr Rivas,
West Towan House,
Porthtowan,
Truro,
Cornwall.

Call for CAD

I need a QL CAD package for printing and designing freight labels. Bearing in mind versatility, accuracy, quality of output and speed, can anybody advise me of a package which would be suitable? Also which printer/plotter would complement your choice?

A. Harris,
196 Oxford Road,
Marlow,
Bucks.

Editor's comment: This request calls for advice from somebody with day-to-day experience of the kind of system described. Any reader who has advice to offer can contact Open Channel or write directly.

Right reply

Procedure check. *Speedmind*, does not give the proper answers for more than two colours the same in sequence. It can be corrected to:

```
Line 1500 : Alter 'temp(guess(count))' to 'temp(count)'
```

```
Line 1550 : Alter both 'temp(guess(count))'s to 'temp(iter)' AND add to the line ':NEXT count.'
```

P. Parry,
Morecambe.

Editor's notebook

This month's Program of the Month, *Ftidy*, has spanned two continents and a trio of editors before gaining our software editor's enthusiastic approval and finding its way into our back pages. Other excellent programs arrive here and are in print two or three months later — but they are a minority. The latest news for those awaiting a report is that we have 166 programs on the log, and a batch culminating at number 80 has just been turned over to the Prof.

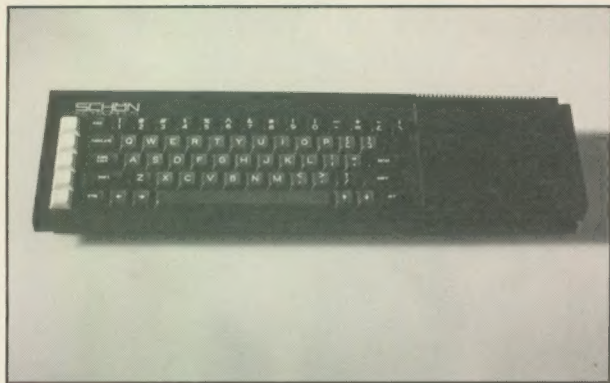
Two hints for programmers in the polishing stage; all else being equal, a program will move through the system faster if it arrives with a ready-to-publish listing, dark print on white paper, single spaced, with a width of three inches (quarter page column), five inches (half page column) or A4 (full page width), according to which column width leaves least white space in the listing. The exact 'best size' depends on the type size of the printer but we rarely reduce below 70 percent, as a guideline.

Printerless people, do not despair. If a good program arrives without a listing, we will list it. It takes a little longer.

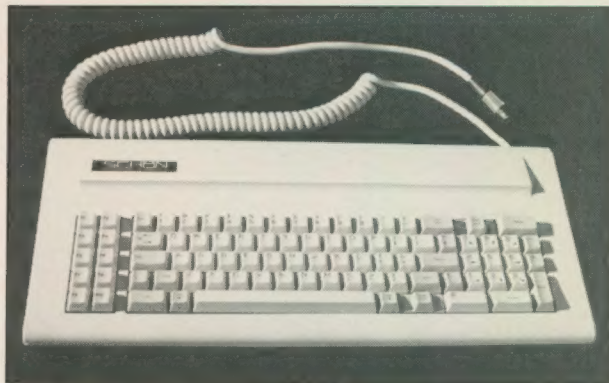
There are rumours that "this summer has not been so quiet as most summers". To which I can only respond, "what summer?"

HARDWARE

(04865) 3836



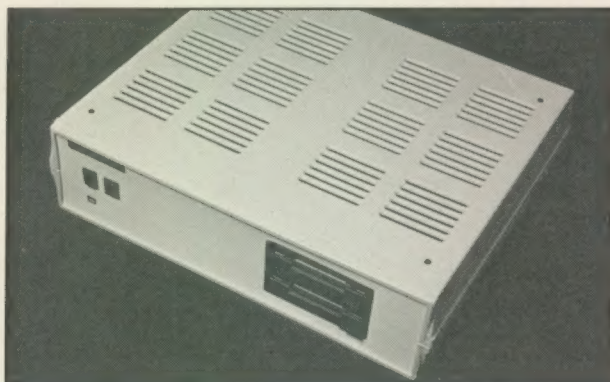
◀ SCHÖN
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Schön Standard Keyboard: Still the most widely sold keyboard for the Sinclair QL. The Standard replacement has a similar key layout to the original but has proper full 4mm travel keys. Ideal for the owner with continual membrane problems or just restricted to space. All 64 keys are two shot moulded and both microdrives and expansion ports are unaffected. New QL cover and anti-bounce device included in price. **INSTALLATION:** Screwdriver, no soldering - 5 minutes. Guarantee - 1 yr +. Spec sheet available.

Schön PC Keyboard: The only IBM style keyboard available for the QL with specific QL functions. The 86 key layout includes single key commands such as delete left/right, break, pause, system request (Ctrl C), diagonal cursor keys, 10 function keys, illuminated Caps and Num lock keys. The PC keyboard comes complete with keyboard interface and cover plate to protect the QL circuitry. This cover plate still allows microdrive access and expansion port entry. **INSTALLATION:** Screwdriver, no soldering. This keyboard will certainly alter your approach to the QL and is **GUARANTEED** to benefit you. Guarantee 1 yr +. Ignore the rest, look at the best. Spec sheet available. Dustcover for PC keyboard £4.95.



◀ SCHÖN
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QL CASING

Schön KBL 128 Computer Casing: Another high quality British product from Schön. This is a special product for the enthusiastic QL owner. Comprising of an inner metal chassis and a strong ABS outer casing it is the perfect DIY challenge to a competent QL owner who suffers from the '4ft long problem'. The Schön KBL 128 comes complete with mounting screws and a 64 way 'flip back' cable to position expansion devices on top of the QL circuit board. There is plenty of space to include both 5.25" & 3.5" disk drives, power supplies, cooling fans, etc. Full spec sheet available upon request and plenty of telephone advice and suggestions. A highly rewarding project which works superbly in conjunction with the Schön PC keyboard. Price only £65.00 including 64 way cable, VAT, postage and packing and of course our supportive advice. Please telephone to chat about converting your QL. (*Cooling fans available if required*).

SOFTWARE - BY ULTRASOFT

QKICK V4.0 TRANSPARENT UTILITY FOR QL

QKICK is a multi-tasking program for the Sinclair QL which runs in the background of almost every program. Using a pull down menu structure it offers numerous facilities which can be used whilst in a major program, facilities which normally would have to be done in Superbasic. Program activation is through a 'hotkey' and upon entry numerous options are shown. Basic Program Facilities: file manipulation, disk or ram, copy, backup, rename, delete, format, start job. User accessories including, NOTEPAD, DIARY, CALENDAR, DATABASE, SCIENTIFIC CALCULATOR, HEX-DEC/DEC-HEX converters. Tools include powerful HEX/DEC editor which can be used on memory, files and even disk sectors, JOB CONTROL, status display, priority change, removal etc. QKICK also includes automatic screen switch off. Please telephone or write for full spec sheet as

there is too much to mention in 1 advert. QKICK is available ex-stock for £21.95 including VAT and postage.

DISKTOOL V2.10

DISKTOOL V.2.10 is another multi-tasking program which again runs in the background without interfering and can be called upon whenever necessary. It appears as a compact window which can be positioned anywhere on the screen and the icon control enables quick access to all facilities. Options include DISK COPIER (icon controlled), DISK FORMATTER (formats an extra 72 sectors per disk!), DISK PROTECTOR (allows entry codes to be put on disks, directory shows up as blank and reads PROTECTED). Please telephone for further details. Superb transparent utility at only £9.95 including VAT and postage.

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DIY TOOLKIT



*Simon Goodwin
continues with the
second half of his
survey of common
QL code errors.*

Most Qdos routines return an error code in register DO. The code is zero if the routine worked correctly or a negative number if a problem occurred. Unfortunately it is very tempting to call a routine without checking the error code. If you assume that a routine gives a valid result it may work satisfactorily when you test it with sensible data but give mysterious results under other circumstances. It is worth remembering that the zero flag normally is not set after a TRAP, even if the value in DO is zero. You must write:

```
TRAP #3  
STS.L DO  
BMI ERROR
```

rather than

```
TRAP #3  
BMI ERROR
```

Most of the vectored utilities — routines called with a MOVE to an address register and an indirect JSR — return with the zero flag set if successful but it is dangerous to assume this.

Often code in resident procedures and functions gives up as soon as an error occurs, returning the error code directly to the caller. This works well until you have subroutines inside your resident code; if an error occurs in one of these subroutines

you must check the value in DO after every call to it, in case the routine is trying to give up.

If you are sure the subroutine will always be called at a specific level in the program — say it will always be called directly by the main code for the command — you can save time and memory by writing a 'fast exit' direct to the last-but-one caller:

```
EXIT ADDQ.L #4,A7  
RTS
```

This technique can get you into deep trouble if a routine which uses it is called at some other level but you forget to check DO after every call to a routine which calls a routine which can use a 'fast exit.' Such bugs can be very difficult to trace; you should plan your program on paper to make sure they cannot occur.

By default, QL assemblers assume that values are 16-bit words unless 32-bit long words or 8-bit bytes are specified with .L or .B respectively. If an address offset may be more than 32K in size you must explicitly put .L after the register name. This requirement caught Sinclair in many parts of the first QL SuperBasic, which used to crash horribly if programs grew beyond about 32K in size.

Call crash

By the time the AH and JM early production versions were finished most of those errors had been eliminated, although one persisted in the CALL statement. The system crashed

if you tried to CALL code from programs more than 32K long, because Sinclair fetched the address of the routine to be called from the maths stack with the instruction:

```
MOVE.L 0(A6,A1),-(A7)
```

The problem is that the 68008 assembler specification says that A1 should be treated as a WORD value in that line, so offsets above 32K give the QL an excuse to look in the wrong place for the code. The correct line, introduced in the JS and MG ROMS, is:

```
MOVE.L 0(A6,A1.L),-(A7)
```

The first address register in an instruction like this is always assumed to be a 32-bit value, whereas the second one can be a word or a long word. The base address of Basic, in A6, is always more than 32K, so I prefer to put it second in my programs:

```
MOVE.L 0(A1,A6.L),-(A7)
```

The advantage is that if I forget the '.L' the program is guaranteed to fail under all circumstances, so I can be reasonably confident I will find the typing mistake. The other order, chosen by Sinclair, is more conventional but can lead to problems which reveal themselves only when you start to use offsets above 32K. Both sequences work at the same speed and I would rather not give myself the chance to miss the error.

The 68008 looping instruction DBRA counts backwards in steps of one every time it loops until the result is -1, when looping stops. DBRA often confuses programmers. Only the bottom 16 bits of the counting register are used, so the maximum number of loops is 65,536 if you start with the value -1, which becomes -2 before it is checked.

Over-looped

Because the count ends at -1 you must start with the data register holding one fewer than the number of loops you want to be performed. It is common to find programs which loop once too often. Another silly bug which often occurs is a program which counts in bytes but moves words, or long words, or vice versa.

Last December I explained that Psion had problems getting Archive to handle an index of more than 32K. Most of the problems stemmed from inconsistent use of signed and unsigned comparisons. The QL ROM contains similar but less important inconsistencies. Some QL instruc-

tions are meant to work with values ranging from 0 to the maximum which can be held in the appropriate number of bits, whereas others treat half the possible values as negative. A 16-bit value can be an unsigned number between 0 and 65,535 or a signed number between -32,768 and +32,767.

Twos complement

A trick called twos complement arithmetic is used; this means that comparisons work much as normal but unsigned values over 32,767 are treated as counting down from -32,768 — where you would expect 32,768 — to -1, where you would expect 65,535. A number is negative, in twos complement, if the most significant bit of the value is set.

There is no problem comparing values to see if they are equal or unequal, so long as they are both in the same form, signed or unsigned. You run into trouble if you mix the types, as noted, as -32,768 and 32,768 have the same representation; that is why the QL ROM thinks -32,768 DIV -1 is -32,768.

The instructions which perform signed and unsigned comparisons have confusing names; if BLS stands for 'Branch if Lower or Same' and BLE stands for 'Branch if Lower or Equal', can you guess which is signed and which unsigned?

Programs work well until you need to use the extra bit unsigned arithmetic provides, at which point terrible things can happen if you have used the incorrect type of comparison somewhere by mistake and your tests and checks give the opposite result that you planned.

Twos complement maths is neat but potentially dangerous, because a signed test works just like an unsigned one, or vice versa, until one or other value has its top bit set. Then it becomes crucial to choose the correct test if you want to know the sequence of two values you are comparing.

Table one shows which test you should use for signed and unsigned comparisons, assuming you are testing after the instruction CMP D1,DO, which sets the flags to indicate the result if you were to take D1 from DO.

When a resident function returns a value to SuperBasic it stores the value in an area of memory called the Maths Stack. The name is something of a misnomer, as the area is used to store strings of characters as well as numbers. The type of value stored must be indicated in register D4 when a function finishes; 1 indicates a

string, 2 a floating point number and 3 an integer.

There is no guarantee that the maths stack will be big enough to hold the value you want to return. Your code must tell the system how much memory it needs with the exceptionally strangely-named BV.CHRIX system call. You pass the number of extra bytes needed, over and above bytes already allocated, in register D1.

The amount of data already in the area is taken into account when you call BV.CHRIX, so you must make sure the system knows the current limit of the area. You tell it this by storing the value of register A1 in the Basic system variable BV.RIP before you call BV.CHRIX:

```
MOVE.L #BYTE-COUNT, D1
MOVE.L A1, BV.RIP(A6)
MOVE.W $BV.CHRIX, A2
JSR (A2)
MOVE.L BV.RIP(A6), A1
```

Notice that the call may change BV.RIP. It is for you to re-load A1 if need be and subtract room for the result, storing it back at BV.RIP. A1 is not the Maths Stack pointer — it is just a register used conventionally when manipulating the stack. You must check BV.RIP if you want to know where they system thinks the stack ends.

If you forget to call BV.CHRIX when a function returns, the effect of storing your value will vary depending on the amount of unused space in the Maths Stack area. If other commands have expanded the area, and left empty space, your code may work satisfactorily for the time being.

If you start a programming session by using a function which does not check for space you may find that the system locks-up when the returned value affects whatever the QL is keeping in the next section of memory. Sinclair fell foul of this problem when it rushed the JS version of the QL. The function VER\$ just puts the length "2" and the characters "JS" on the stack, without

checking if there is room for them. This means that the line:

```
IF VER$="JS"...
```

crashes a "JS" QL if you use it immediately after turning on the machine. It works well if you do some calculations beforehand to make room on the stack.

One simple but slow way to expand the stack space is to use a command like:

```
X = FILL$( "0", 32760)
```

but this is no substitute for checking that there is room before you stack a value.

Note that the BV.CHRIX system call is slow and best avoided if you can do so safely. Sometimes you can be sure that there is room to stack the result of a function, because it will occupy space used previously by the system to pass parameters.

A function which takes one or more numeric parameters and returns a result of the same type never needs to call BV.CHRIX as the required space will have been found, if necessary, by the system routines which fetched the parameters. Beware — do not try this with functions which return arbitrary length strings.

Sometimes I see SuperBasic functions which work perfectly if they are used in simple assignments but give odd results if you use them in expressions. This kind of problem usually stems from an unbalanced stack; it may not be obvious in simple tests but it can crash the machine, so it is an important bug to detect.

To illustrate the point, imagine a trivial function DIFFERENCE, which takes two floating point numbers and returns their difference. If X is 2 and I type PRINT DIFFERENCE(X,X), I get 0, as expected, but if I try:

```
PRINT 4 = DIFFERENCE(X,X)
```

I might get a result of 2 rather than the 4 I expected.

To understand the bug we need to know how SuperBasic parameter fetching works. Extensions usually start by calling a ROM routine to copy the parameters on to the maths stack. ADDUP needs two floating point parameters, so we call CA.GTFP and check that the number of parameters returned in D3 is correct. If all is well the two values will finish on the Maths Stack.

Our code can read the values and work out the result but it must tidy the stack before returning and this is where the bug is introduced. If we put the result on top of the stack and



return, without de-allocating the second space, we over-write one parameter but leave the other in place on the stack.

When the computer does the addition it finds the two most recent values on the stack are 0, the result from DIFFERENCE, and 2, the parameter which was overlooked. The 4 is still stored but it is never used because the '2' has got in the way. The result printed is 2+0 instead of 4+0.

You should always test new functions inside expressions, as well as on lines of their own. You need not worry about keeping the stack straight if you use the ROM arithmetic package to process numbers, as it adjusts BV.RIP automatically before storing results.

Stacking mistakes can have other repercussions besides giving you the incorrect answer. Every time you call DIFFERENCE, one value is left on the Maths Stack, occupying six bytes of memory. If the calculation is in a loop these 'spare' values accumulate quickly. Memory is eaten up until the program stops with an out-of-memory error.

Even nastier things can happen. If you leave an extra two bytes on the stack, rather than a complete floating point number, subsequent calculations may work with part of the value

you would expect and part of the unexpected data. All kinds of strange values can finish inside the system and some, like floating point numbers with exponents greater than 4,095, can crash the QL internal calculator.

Luckily this problem does not usually occur in procedures. The system tidies the Maths Stack for you when a procedure has run successfully and after any error. It is a pity it

does not check that function results are stacked correctly, since it knows the type of the result.

● In next month's QL World *DIY Toolkit* will offer machine code for you to examine and customise. If you would like me to explore a specific area in this column, or implement new commands, particularly ones unavailable in commercial toolkits, please send your suggestions.

Table 1
68008 signed and unsigned comparisons
After CMP D1,DO you can test the result as follows:

Condition	Signed test	Unsigned test	
IF DO < D1...	BLT	BCS	
IF DO <= D1...	BLE	BLS	
IF DO > D1...	BGT	BHI	
IF DO >= D1...	BGE	BCC	
Maths stalk			
Print difference (x,x) Correct result = 0	Before call	After call	
	x (2)	x (2)	Result, 0
Print 8 + difference (x,x) Correct result = 8 Actual result = 2	Before call	After call	After add
	8 x (2)	8 x (2)	8 Result, 2
Print 5*(3 = difference(x,x)) Correct result = 15 Actual result = 6, computer as 0 = 2*3	Before call	After call	After multiply
	5 3 x (2) x (2)	5 3 x (2) Result, 0	5 Result, 0

Stack contents when using a faulty function

As its name suggests, *Morse Practice Machine* is a program designed to provide Morse code receiving practice to assist learning. The program is aimed at the prospective radio amateur trying to pass the Morse code test and gain a full class A licence.

I did what I normally do with an unfamiliar piece of software. I took a cursory glance at the instructions in case it had something vital to say about loading the program; then I switched on the QL, inserted the cartridge in MDV1— and pressed F2. The program self-booted without difficulty and put up some fancy credits which scrolled up the screen, informing me that the program had been written by Shirley Jane Peters, G0ECE.

After a second screen of credits flashed on for a moment, the program proper started. It is menu-driven and can be used

MORSE REVIEW

without reference to the instructions. The program will transmit Morse to you, using the sound facility on the QL, at a selectable speed between four and 12 words per minute. It transmits the contents of a text buffer, which can be examined to check how accurately you have received the Morse.

The program can fill the text buffer with random groupings of letters or numbers, or with semi-random groupings, selected from the characters on which you decide you need most practice. Alternatively you, or someone helping you, can fill the text buffer with any text which the program will convert to Morse and send on demand.

Up to 10 memories containing a buffer full of text may be stored in RAM and may be saved to and loaded from Microdrive. The package is accompanied by

Andrew Armstrong revises his dots and dashes.

some example text on the Microdrive to help you get started. The program also has a clock displayed continuously so that you can time your practice sessions. You can even adjust the pitch at which the Morse is sent.

The program documentation explained adequately any features which were not obvious from the program menus. More useful, though, was the section of suggestions as to how to learn Morse most effectively. The writer clearly suggests that, while the computer-generated Morse is correct, some hand-sent Morse is also necessary for proper practice. That may be true but the machine can do a good deal. If such a thing had been available when I learned Morse it would have saved hours of effort.

There is one reason why

some practice with hand-sent Morse is necessary and that is my only criticism of the program. The amateur radio Morse test is at 12 wpm, the maximum speed of the program, but I think it is a good idea to reach a standard somewhat higher than the test speed before taking the test, to make some allowance for examination nerves. When I took the test I could manage 14wpm outside the test room and barely 12wpm inside it. The program is in compiled form, so it would not be easy for the user to tweak it. Perhaps the facility to handle 15wpm would be a reasonable update.

All in all, though, anyone wanting to learn Morse could do worse than to use this package.

Program: Morse Practice Machine
Supplier: Caravan Software, 60 Tantallon Road, London SW12 8DG.
Price: £12

S E C T O R

QL WORLD INDEX

The QL World Index is a complete reference to all Sinclair QL World/QL User articles compressed to fit in a standard QL.

In one second it will find any article by name, author or subject. For example; "printer" will find all references to printers from QL World or QL User. "Dillon" will find all articles by Charles Dillon. Everything worth knowing that has appeared in QL world and QL User from its launch in June 1983 to the current issue is included. An invaluable guide for anyone who has a collection of these magazines or wants to order back issues.

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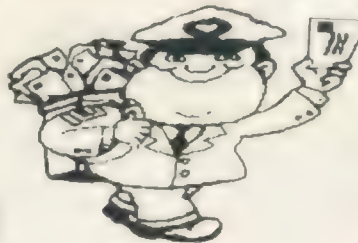
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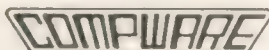
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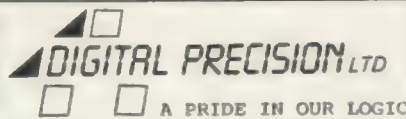
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SB

SUPER BASIC

Mike Lloyd assesses the value of linked lists in Basic programming.

Linked lists used to be in every programmer's repertoire until computer languages provided ready-made data structures such as arrays. The existence of arrays has made us lazy and they are not the answer to all data storage problems. Linked lists still have their uses in SuperBasic and machine code programmers in particular may welcome the opportunity to experiment with them in Basic before encountering them in the more forbidding world of assembly language.

The concept of a linked list is straightforward. Each data item in a simple linked list comprises a piece of data and a pointer to the location of the next item in the list. Linked lists are rather like treasure hunts in the computer memory; at each location you can find a piece of information and a clue to where the next treasure site lies.

Figure one shows in diagrammatic form the simplest kind of linked list. It is no coincidence that the list is of Basic keywords, because the QL maintains a linked list of all

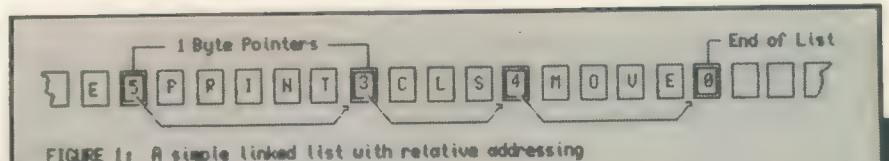


FIGURE 1: A simple linked list with relative addressing

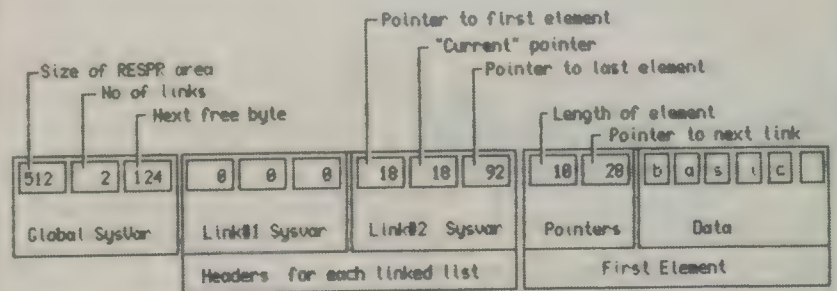


FIGURE 2: Structure of the linked list area produced by the listings

keywords, SuperBasic extensions and variable names.

SuperBasic string arrays also use a linked list format. At the beginning of each element a two-byte integer is stored in RAM which indicates total length of the string. As the elements

of a string array are located next to each other in the computer memory, these bytes form *relative pointers* to the beginning of the next string.

The way the QL stores strings explains three phenomena concerning them. First, the maximum length of a

Listing 1

```

100 DEFINE PROCEDURE SetLinkArea (size,links)
105 LOCAL x
110 IF size > 64: Warn 2: RETURN
115 LinkBase = RESPR(size *1024)
120 POKE_W SysVar (0), size *1024 -1
125 POKE_W SysVar (1), links
130 POKE_W SysVar (2), (links +1) *6
135 FOR x = 1 TO links: POKE_W SysVar (x*3), 0
140 END DEFINE SetLinkArea

```

strong is fixed at 32,766 because it is the highest positive number obtained from two bytes using twos complement arithmetic. A second feature of QL strings is that they are always an even number of characters long, even if the programmer intended them to have an odd number of characters. That is because Qdos requires that two-byte words such as link pointers begin at an even address, so some strings must be padded with an additional space.

The third oddity concerns the first character of each element in string arrays. If a single-dimensioned array A\$ is declared and has a string assigned to it, such as:

```
DIM A$(10)
LET A$="Hello"
```

printing the zero element of that string produces, rather unexpectedly, the length of the string. In other words:

```
PRINT A$(0)
```

produces the output "5". Instead of printing the character represented by the zero byte the interpreter decodes and prints the string pointer value.

The Qdos name table and SuperBasic string arrays are two examples of primitive linked lists. The advantages of linked lists are that they use memory efficiently, they are infinitely adaptable and they can be managed with very little overhead in the way of user-defined procedures. A number of linked lists can share the same memory area satisfactorily and be mixed apparently inextricably without causing problems.

Linked lists are sorted quickly by updating pointer values rather than by shunting around large amounts of

data in memory. Linked lists can accommodate any number of chains of pointers, making them ideal for binary trees, digraphs and even more sophisticated data structures. Finally, in machine code programs where SuperBasic arrays do not exist, linked lists are essential.

Linked lists can handle all the main activities of data management but work with maximum efficiency; they are usually tailored to suit specific applications. Arrays, on the other hand, are more general-purpose in nature. Accordingly, the accompanying program is not a general utility but rather an example of how a linked-list data structure could be developed. Its special features are that it permits any number of linked lists to share an area of RAM and it allows users to access data either one list at a time or across all the lists.

The first decision to make when contemplating a linked list concerns the structure *domain*, or the memory area in which it will exist. The domain must have the capacity to hold all the data required but still leave sufficient room for other things, such as the program which will control it. On an unexpanded QL 64KB is a sensible maximum but for the majority of purposes considerably less would suffice.

Wasteful

A pointer system must then be devised. Pointers might, for instance, use *absolute addresses*. They require four bytes of memory per pointer. This wasteful use of memory and fondness of the QL for shunting things round in RAM conspire to make absolute addressing a rarity. The alternative is *relative addressing*, in which pointers indicate offsets

from some other byte in memory.

Offsets can be measured from the location of the pointer, so if a pointer at memory location 64000 has a value of 300 the next pointer will be at location 64300. Another method is to calculate the offset from a single point, usually the start of a data structure area.

Reserved Memory

Qdos tables tend to use the former method of offsets because the QL CPU is particularly adept at adding offsets to current addresses. The accompanying program uses the latter method. Whichever system is chosen, only two bytes are needed to cope with offsets of up to 64KB, more than sufficient for the majority on application.

The printed listings produce a single linked-list area in memory which can support any number of separate lists. As new items are added to the memory area they are placed adjacent to the last-entered item and linked to the previous member of the list to which they belong. The process can be likened to recording placings in the Fastnet yacht race. The competitors are placed in an overall list as they cross the finishing line and they are also added to the list for their particular class of boat.

Listing one establishes the RAM area required to hold the linked lists. Attempts to reserve an area larger than 64KB produce error messages. Two parameters are required — the size of the reserved memory area in kilobytes and the number of linked lists which are to be established. Once those values have been set they cannot be changed. The procedure must be run once only when the linked list system is first generated.

To make the program easier to understand two short functions and a procedure have been written — listings three, four and five. The first function, SysVar, refers to the system variables which are stored at the beginning of the reserved RAM space. Each system variable occupies a *word*, or two bytes. The first three words hold information referring to the entire linked list system and there are in addition three words for each list established. Their specific purposes are:

- | SysVar Description | |
|--------------------|----------------------------------|
| 00 | The length of the reserved area. |
| 01 | The number of separate lists. |
| 02 | Pointer to the next free byte. |



```
200 DEFINE PROCEDURE Additem (a$, link)
204 LOCAL FillFactor, , Byte
208 IF Wrong_Link (link): STOP
212 IF LEN(a$) MOD 2: a$ = a$ & " "
216 FillFactor = INT ((PEEK_W (SysVar (2)) + 4 + LEN (a$)) /
PEEK_W (SysVar (0)) * 100)
220 SELECT ON FillFactor = 00 TO 99: Warn FillFactor
224 IF FillFactor >= 100: Warn 4: STOP
228 Byte = LinkBase + PEEK_W (SysVar (2))
232 POKE_W Byte, LEN (a$) + 4
236 POKE_W Byte + 2, 0
240 IF PEEK_W (SysVar (link * 3)) = 0
244 POKE_W SysVar (link * 3), PEEK_W (SysVar (2))
248 POKE_W SysVar (link * 3 + 1), PEEK_W (SysVar (2))
252 ELSE
256 POKE_W LinkBase + PEEK_W (SysVar (link * 3 + 2)) + 2,
PEEK_W (SysVar (2))
260 END IF
264 POKE_W SysVar (link * 3 + 2), PEEK_W (SysVar (2))
268 FOR x = 1 TO LEN (a$): POKE Byte + 3 * x, CODE (a$ (x))
272 POKE_W SysVar (2), PEEK_W (SysVar (2)) + 4 + LEN (a$)
276 POKE_W LinkBase + PEEK_W (SysVar (2)), 0
280 END DEFINE Additem

300 DEFINE FUNCTION SysVar (offset)
305 RETURN LinkBase + 2 * offset
310 END DEFINE SysVar
```

◀ Listing 2

◀ Listing 3



The cure for an overloaded data area is to save the reserved area and then allocated a larger slice of RAM with the following sequence of commands:

SBYTES mdv1—yourname, LinkBase, PEEK—W(SysVar(0)) NewSize-48: REMark: A suitable

256 Set the pointer of the previous item in the list

260 End the IF clause

264 Set the "last item" pointer

The remainder of the procedure accomplishes three tasks. The data string is poked one character at a time into RAM; the "next free byte" pointer at the beginning of the memory area is updated; and the next free byte is set to zero.

Listing three calculates the absolute address of a system variable word, given its offset from the beginning of the reserved memory area. Listing four is a simple device to ensure that an incorrect link-list identification number is discovered and reported before the data is corrupted. The last utility procedure, listing five, is a collection of warning messages. Note that values 80 to 99 are associated with the FillFactor calculated in the AddItem procedure.

Variable Byte

The final listing allows the contents of a specified list to be output to a given channel. The channel and the list number are passed as parameter. Incorrect list identifiers are trapped but the programmer must ensure that valid channel numbers are used.

Listing six uses the system variables to discover the start address of the first item in the chosen linked list and stores it in the variable *Byte*. The remainder of the procedure is repeated once for each item in the linked list.

The first two bytes of each list element reveal how many characters

```
400 DEFine FuNction Wrong_Link (link)
405 LOCAL x
410 x = INT (link)
415 SElect ON x
420 = 1 TO PEEK_W (SysVar (1)): RETURN 0
425 = REMAINDER : Warn 1: RETURN 1
430 END SElect
435 END DEFine Wrong_Link
```

```
500 DEFine PROCedure Warn (x)
505 SElect ON x
510 = 1: PRINT#0, "ERROR: Invalid Link Value"
515 = 2: PRINT#0, "ERROR: Link Area Too Large"
520 = 3: PRINT#0, "ERROR: Invalid Item"
525 = 4: PRINT#0, "ERROR: Link Area Full"
530 = 80 TO 99
535 PRINT#0, "Warning: Link Area "; x; "% full"
540 END SElect
545 END DEFine Warn
```

◀ Listing 4

◀ Listing 5

- 03 Pointer to the first item of list 1.
- 04 Pointer to the "current" item of list 1.
- 05 Pointer to the last item of list 1.
- 06
- 07 — Pointers for list 2.
- 08

*number of Kb less than 64
LinkBase-RESPR (NewSize*1024)
LBYTES mdv1—yourname, LinkBase
POKE—W SysVar (0), NewSize*1024-1*

The most important value used in listing one is the address of the next free byte, recorded in the variable *Byte*. Each list element comprises three components — a two-byte value recording its length, a two-byte pointer to the next item in the list and, finally, the data. The last item in each list has a pointer value of zero.

and so on. Figure two shows the layout of the first few bytes of the linked list area.

FillFactor

The initial values of the three global system variables are calculated in listing one. System variables relating to individual lists are set to zero.

Before the linked list area can be of value some data items must be added to it. This is achieved by listing two. Two parameters are required — the datum, here restricted to a string, and the identification number of the linked list to which it is to be appended.

To ensure that each list element begins on an even-addressed byte, odd-length strings must have additional spaces appended to them. The extent to which the reserved area has been used is then calculated and recorded as a percentage value in the variable *FillFactor*. If the fill factor rises above 80 percent warnings are printed; if there is insufficient room for a new item it will not be accepted and the error is reported.

```
600 DEFine PROCedure PrintLink (chan, link)
605 LOCAL loop, x, Byte
610 IF Wrong_Link (link): STOP
615 Byte = LinkBase + PEEK_W (SysVar (link *3))
620 REpeat loop
625   FOR x = 4 TO PEEK_W (Byte) -1
630     PRINT#chan, CHR# (PEEK (Byte +x));
635   END FOR x
640   PRINT#chan
645   IF PEEK_W (Byte +2) = 0: EXIT loop
650   Byte = LinkBase + PEEK_W (Byte +2)
655 END REpeat loop
660 END DEFine Print_Link
```

▶ Listing 6

Lines 245 to 270 update system variables according to whether the item being added begins a new list or is an addition to an existing list. A psuedo-code interpretation is:

240 If the data item begins a new list

...
*244 Set the "start of list" pointer
248 Set the "current item" pointer
252 Else ...*

are to be printed-out by the PRINT statement in the FOR...NEXT loop. The second pair of bytes is used to update the variable *Byte* to point to the next element of the list. A value of zero indicates that the list is complete and the REPEAT loop is ended.

● *The concluding article of this series on simple linked lists will introduce additional procedures for managing linked lists.*



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THOR XVI

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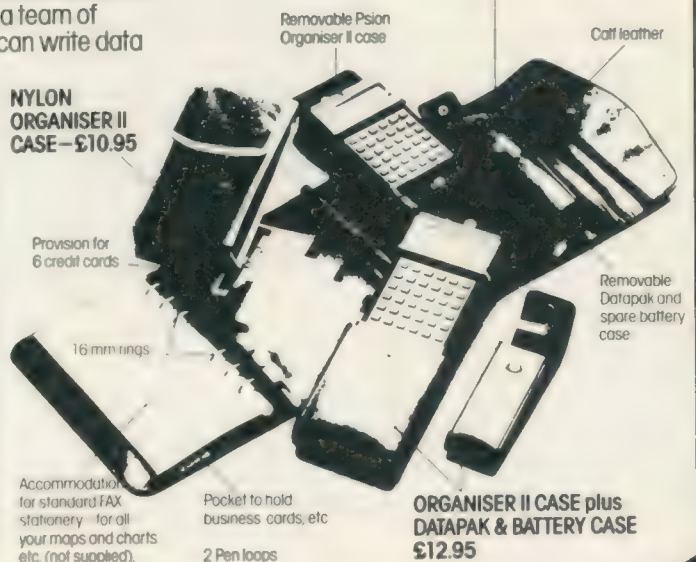


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The QL screen driver, an important part of the operating system, Qdos, supports many combinations of features, e.g., windows, borders, ink and paper colour, character size, flash, underscore. Those who have spent the best years of their youth inside Qdos suggest that most of the features are implemented in fewer than 500 bytes of code, an impressive programming feat.

The constraints on programmers at that time were to squeeze the whole operating system and SuperBasic into 48K of ROM. Programmers constantly take up battle in the conflict of size against speed. Usually the faster the implementation the greater the memory requirement.

Not very fast

One consequence of packing the bulk of the QL screen handling into such a small amount of code is that the QL screen response is not very fast. This problem and the shape of the solution have been identified virtually from the outset. Until recently, however, no-one had succeeded in releasing a product which addressed the problem, although the design and prototype solution was prepared more than two years ago for the much-awaited and sorely-missed QL successor, the Futura.

Digital Precision has recently released a screen accelerator, *Lightning*, consisting of a set of program files to be loaded into the QL/Thor and which effectively take over the responsibility for all screen output. The *Lightning* user enjoys increased speed in screen handling almost irrespective of what program is running on the machine. *Lightning* will provide a benefit on the QL, the Thor and the Thor XVI. One version of *Lightning* will run equally well on any of those machines.

Many readers will wonder

if I am referring to *Speedscreen* from Creative Codeworks. The basic description of both programs is similar, making comparison between them inevitable. *Lightning* benefits from being 'the second kid on the block' in that some of the problems remaining in *Speedscreen* have been avoided or corrected in *Lightning*. While *Lightning* runs on any QL or

clearing in mode 8. *Lightning* strikes beyond text enhancement. The package includes two more elements, neither of which is provided by *Speedscreen*. The first extra is the ability to speed graphical screen output, plotting of lines, circles, ellipses and area fill. The second extra is the provision of a maths package. This feature takes over many of the

to check that a large file is readable — does not contain bad blocks — you could use the command:

```
"copy flp2—bigfile, nul"
```

You will be surprised how fast the command completes. This is a fairly trivial example but the facility has many other uses. There is also a similar capability to switch screen output on and off when copying a large file to screen.

To complete the package are three demonstration files, one for each *Lightning* component, and about 40 font definition files. While these may be very pretty and represent a good deal of work, their relevance in an acceleration context is not clear. None of the fonts is claimed to be faster than any other, nor is any way indicated of attaching your favourite font to, say, Quill.

Nonetheless, they represent a fairly substantial addition, if you can find a use for them. Digital is said to be thinking about an extra utility to attach a font to any screen channel you choose. *Lightning* has a 46-page manual, tiny when compared to most other Digital manuals. Ten pages could have done the same job but the manual is clearly-indexed and the pieces you need to read or which may be of interest are easy to find.

Straightforward

Setting-up a system to use *Lightning* is pleasantly straightforward. The three component parts — text accelerator, graphics accelerator and maths accelerator — are supplied with —ext suffix as separate files and can operate independently of each other. The respective file sizes are approximately 21.5K, 6K, 4K. The whole bundle weighs 31K. For 128K users a mini text accelerator costs 4K though inevitably it is not as comprehensive as the full file.

A configuration program is provided which allows you to select the component parts you need. *Lightning* will write a tailored boot file which can be linked to your system disc or loading program.

A rumour from the East

Lightning strikes QL



John Silk takes a look at *Lightning*, a screen accelerator recently released from Digital Precision.

derivative, a dedicated version of *Speedscreen* is required for each model.

Speedscreen confines itself to enhancing screen handling of standard size text — mode 4 — and generally hands over to Qdos in other modes except for scrolling and screen

mathematical functions provided by the QL operating system and speeds them.

There are two other items with *Lightning*. One is the provision of a "null" device. It could be used as a drain for output or as a guaranteed end of file for input. If you needed

suggests that Lightning, like W C Fields, likes to be loaded first before it starts work. If not loaded before, say, QRAM, Tebby Toolkit, TaskMaster or whatever, you may get some weird screen-handling effects later in the session. No particular problems were experienced during testing but the recommended loading order should be followed.

Several variants

Lightning claims justifiably to handle all screen text output for character CSIZE 0,0 and CSIZE 1,0; they are by far the most frequently-used character sizes. For these CSIZES text in all attribute combinations — OVER, UNDER, INK, STRIP — is accommodated. Other screen-handling operations are also speeded. This includes the several variants of CLS (Clear screen) and SCROLL. Any text in a character size or mode outside the range of Lightning is passed through to the

native Qdos screen handler to be processed.

All the accelerator functions occur automatically. For inveterate fiddlers, DP has provided a few knobs to twiddle. The knobs are in the form of extra SuperBasic commands. Each command is prefixed by “—Ing”. There are “—IngOFF” and “—IngON” — they turn the text accelerator off and on. “—IngGRAF” is followed by either 0 or 1 to switch the graphics accelerator off or on. “—IngPREC” allows you to specify the computer precision for the maths accelerator.

The qualifying number should be one of 0, 1, 2, 4. The value 0 switches back to the Qdos native routines. The values 1, 2 and 4 specify the number of bytes of the mantissa to be used. The value 4 is the standard and apart from switching off (0), you will have to think long and hard before using the others.

“—IngZIP” allows you to

specify the number of blank lines which should be scrolled when the scroll display reaches the bottom line of the window. There are another five extra keywords provided with Lightning dealing with various low-use features. All are described adequately in the manual.

The testing of Lightning was viewed as a two-phase task. Of most importance was to obtain a subjective impression of how my usual daily work was affected. The second aspect was to arrive at some meaningful comparisons of elapsed time. The precise performance delivered by the text accelerator of Lightning depends on several factors — character size, ink colour, strip colour, window position and so on; the manual explains those matters in some detail.

To qualify every test with all this information would make this review more effective than Mogodon. Suffice it to

say that the figures set out are intended to be guidelines. One factor concerning performance must be mentioned. The QL operating system uses slave blocks for handling directory device I/O, so that if sufficient memory is available a second reading of a file on disc may not refer to the disc but instead use an image of the file held in slave blocks. This will enable the second reading to be speeded considerably.

QL configuration

The QL configuration I used included JS ROM, 896KB RAM, dual 720KB disc drives. The Thor XVI configuration was 6.32 ROM, 1.5MB RAM, 20MB hard disc. Thor Speedscreen ROM 6.24F was used on the Thor XVI, QL Speedscreen 1.26F was used on the QL. RAM-based Lightning 1.11 was used on both machines. Note that ROM-based routines typically will run faster than RAM-based routines.

Test 1 — File copy.

I copied a large text file (133KB) to screen, using the SuperBasic command:

```
cls:copy flp2—bigfile,scr
```

This was done several times,

using floppy disc, hard disc and slave blocks as the sources, with screen and the null device as destinations. Scroll rates of '1' and '4' were employed, by using “—IngZIP” or “—scroll” as appropriate.

Test 2 — Editor

I loaded the same file into Editor (v2.06) and issued a command to cause the program to page repeatedly from

the top of file to the bottom (rp 20n). This was followed by another repeat to back-up by one line. The number of lines in the file was 3335.

Thor XVI testing

	Thor Qdos	Lightning 1 4	Speedscreen 1 4
win -> scr	188	105	
flp -> scr	221	170	203
slv -> scr	177	91 36	100 48
flp -> nul		29	
slv -> nul		3	

QL testing

	QL Qdos	Lightning 1 4	Speedscreen 1 4
flp -> scr	517	281	292
slv -> scr	471	237 92	247 100
flp -> nul		67	
slv -> nul		6	

Thor XVI testing

	Thor Qdos	Lightning	Speedscreen
rp 20n	121	65	79
rp p		355	472
rp p (+ cursor key)	192	142	146

QL testing

	QL QDos	Lightning	Speedscreen
rp 20n	528	146	151
rp p		841	831
rp p (+ cursor key)	407	308	311

Test 3 — Graphics

The graphics demonstration program included in the Lightning package is the only sensible demonstration file. The maths demonstration is

meaningless, the test demonstration better-suited for a shrink. Running the graphics demonstration produces the following timings:

	Native	Lightning
Thor XVI:	40	29
QL (mode 4):	109	65
QL (mode 8):	95	57

Lightning strikes QL

Test 4 — Quill block move

With Quill up and running I moved all of page 14 and some 15 lines of the following page to the end of page 12. It took 270 seconds and with Lightning 17 seconds.

Test 5 — Cash Trader Upgrade

This program, fast though it may have appeared hitherto, assumed a noticeable if non-calculable improvement in the speed of its many window-refreshing activities, especially helpful and welcome at data entry time.

Cash Trader uses multiple windows, simple maths and non-standard character sizes. No aspect was affected adversely.

Test 6 — SEDIT

I ran SEDIT, an Archive screen drawing utility from the PDQL stable. While the editing

functionality was speed-enhanced, though again not calculable, the graphics drawing feature in the program was speeded by a factor of six. Speedscreen and SEDIT block graphics are incompatible.

Test 7 — IMAGE-D

IMAGE D is a three-dimensional drawing program written in SuperBasic and Turbo-charged. It requires mathematical calculations to

be made whenever the screen image is to be changed from, say, wireframe to hidden line, to colour shaded, to a different viewing angle, to three views or back to a single view.

First I converted a single image to a three view and the remainder of the test was completed on a screen display of three viewing angles of the original 3D image. The timings in seconds using maths and graphics extensions were as below.

	Qdos	Lightning
Convert image to three view:	12	6
(colour) Shade:	30	20
Hidden line:	35	18
Reduce image size:	33	21
Change viewing angle by 35 degrees on all axes:	36	20

Lightning has been given fairly extensive beta-testing. During the period the review copy has been available a small number of problems have surfaced. Digital Precision has fixed all but one of them. This occurs when a program which uses various CSIZES and the 'print' function is compiled using the MetaComco C library. There is a way round this problem which is to ensure that Lightning is disabled when the program starts — use — lngOFF. Once the program has started, Lightning can be enabled.

One of the justifications of new software is to identify a genuine problem area and to provide a solution. Lightning, like Speedscreen before it, accomplishes that with all the benefits of assessing what the earlier program can and can not do. QL/Thor users should count themselves fortunate that the most frustrating aspect of their computing work can now be removed at a stroke.

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One might say that it is almost inevitable that computers are being integrated into almost every facet of our daily lives. Computer industry fondness for acronyms — Basic and CP/M being only two of the more common examples — while often confusing the user is another example of the evolving tendency for compression of communication concepts.

In this report, three additional terms are used from among the ever-growing catalogue of computer applications — CIM, Computer Integrated Management; CAE, Computer Aided Engineering; and CAD, Computer Assisted Design.

Anyone believing that drawing pretty

jobs such programs do may be considered as either CAE or CAD, 3D programs are more usually restricted to producing visual output which can be viewed from two or more viewpoints as opposed to drawings which are used in manufacture.

Complicated drawings

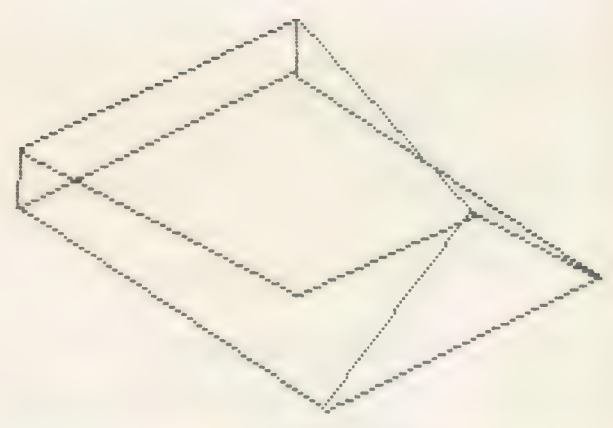
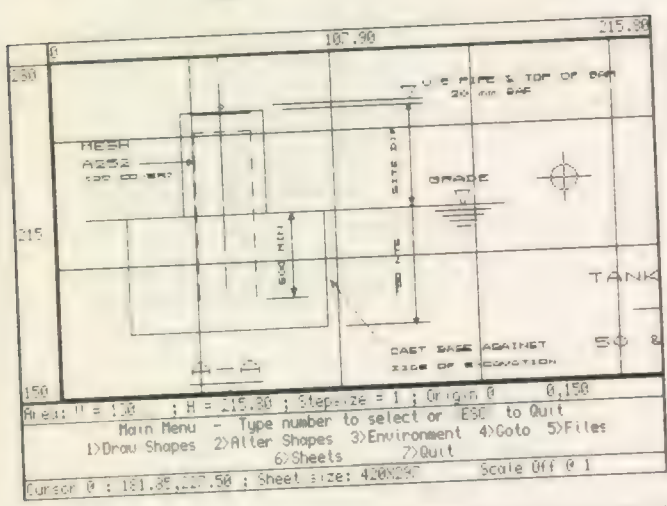
Three-dimensional development systems can produce drawings in either of two modes; wireframe, in which all the points and their connecting lines used for constructing an image are visible — complex drawings can be confusing to look at; or hidden line, where only the planes visible from a single viewpoint —

programs is that, because a screen refresh forces the program to re-calculate the drawing file in memory, the program can spend a considerable amount of time re-drawing its screen, particularly for complicated drawings.

While reviewing the programs included in this report, I used the Digital Precision *Lighting* which produced a considerable speed increase because of its improved screen management, maths and graphics routines.

The odd program out in this survey, the Bestmalt *QL CADette*, differs from the others in that it is concerned solely with the production of two-dimensional drawings. *CADette* is supplied as a system comprising two separate utilities

In perspective



pictures has nothing to do with engineering should consider the extent to which engineering in all its guises affects our lives. Clothing, as one of the more esoteric examples of CAD, often undergoes the same class of stringent study and design as an automobile.

Systems providing facilities for aiding engineering design generally fall within one of two distinct categories. The first, CAE, is applied to all kinds of visual representation or planning development. Such programs generally are confined to a wide range of graphic arts and other visually-orientated development applications, where concepts are also often intended for reproduction in a different medium.

Specialised drawing programs used for viewing one or more objects in three dimensions are usually classed as CAE systems. Although the definitions of the

the camera position — can be seen. Some programs, such as the PDQL *Image D*, offer both modes.

CAD packages differ from conventional art-orientated or drawing programs in five important aspects. They require a more formal approach to design in that a clear concept of the end product is required.

Although the product of a CAD package is a visual medium, the internal workings of the program are more akin to a text editor. Image files produced by CAD programs are unlike conventional screen dumps in that picture files, however devised, consist of drawing parameters analogous to text files.

CAD systems are time-efficient in that working speed is increased greatly by having the potential to produce libraries of standard component symbols. The sole disadvantage of the majority of CAD

linked by its own front-end CAD and PLOT.

The *CADette* screen is divided into two parts — the drawing area, defining the "sheet" and the "action and status" windows, the latter of which is divided further into three windows, the larger central one of which is where the menus, prompts and user interaction occur.

Above and below that window, information is displayed about the program status such as degree of zoom, cursor stepsize and the origin of the displayed area. The lower status window displays the position of the graphics cursor, the physical size of the sheet and scale value.

Entirely menu-driven, the *CADette* CAD module provides all the facilities for drawing and editing existing drawings. Except for the Main Menu, *CADette* Menus may be called by pressing the

number associated with the option required. Alternatively, single keypresses will call some of the options directly — Main Menu, Draw Shapes Menu, Alter Shapes Menu, Environment Menu (or <F2>), Area Displayed Menu, GridPatternMenu, Goto Menu (or <F5>), Files Menu, Sheets Menu and <F4> for a Screen redraw. Navigation in the drawing mode may be incremented with the cursor keys:

Cursor keys — single pixel;
 <SHIFT> cursors — 10 pixels;
 <CTRL> cursors — 50 pixels;
 <CTRL> <SHIFT> cursors — 100 pixel increments.

Alternatively, using the GOTO option, the cursor is positioned at the required

defined independently as anything up to 10 metres square. Scaling may be toggled. When on, with a scale of 25.4, one unit is equal to one inch. When off, one unit is equal to one millimetre. Other scales to any value may be used.

A number of basic geometric shapes, referred to in the manual as "primitives", are provided by CADette — line; if the input parameters include an angle, lines are drawn as an arc; box, with a rotation option, circle, ellipse, regular polygons and triangles. Full text facilities are also provided using the CADette ISO-standard font set.

Since output is the main object of CAD programs, CADette incorporates a number of useful options which may be

the x axis uses the left/right cursor keys; the y axis, the up/down keys; and the z axis with <SPACE> and the up/down keys.

The left/right keys, used with <SPACE>, allow you to edit the next and last points respectively. To step to point four press the right cursor key and the <SPACE> bar three times.

In addition to free-hand drawing, used in conjunction with the Main Menu, Designer will also accept direct keyboard input. The range of points available in any single drawing is two to 1,024. Successive points may be added either by selecting "Increase" from the Main Menu or by pressing <X>.

Altering values

Selecting the "Input" option, you can type-in the x, y and z co-ordinates of the new point directly. Editing a drawing occurs by selecting "Edit". You are then offered the option of altering one, two or three of the co-ordinate values.

Designer is the only other program reviewed in this survey which offers you the option of obtaining a parameter listing of a drawing, either to the screen or a printer.

Drawing with the PDQL Image D occurs mostly by direct input of co-ordinate values and elements contained therein can be treated independently as an object — a group of sections; a section — a single slice; or a point. Its drawing area is limited to 330 x 180 pixels and drawings may be displayed at user-definable scaling factors.

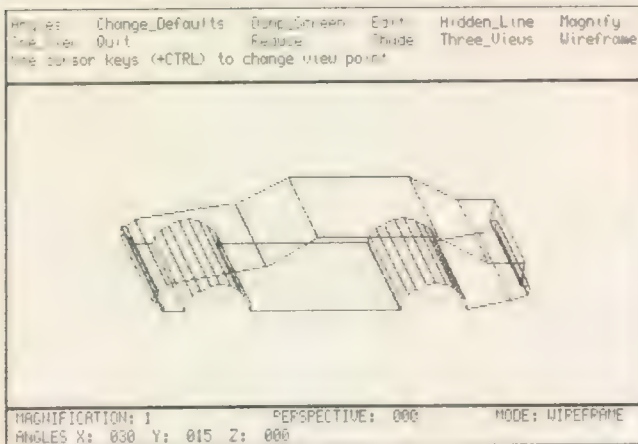
Although Image D will run satisfactorily on a standard QL, memory requirements are about 50K, to which is added the total number of points divided by 10. A drawing consisting of 300 points will require about 80K of total memory.

The screen display is divided into three windows, the uppermost of which accesses all the drawing commands; drawing status is indicated in the lower window and the central window is the drawing area and contains the cursor crosswires.

One of its powerful features is its View mode. When in this mode, you have the option of defining the perspective factor of a drawing; wireframe, hidden line or shade modes; view at different angles; magnify the displayed image; and view the drawing in either a single, full-screen or three-view — front and right elevations and top view — display.

The Digital Precision entry into the field of three-dimensional graphics is particularly interesting from a number of aspects. Supplied as a modular kit of routines for developing, editing and using 3D images, *3D Precision* provides all the facilities you are likely to need for

Ron Massey reviews some of the latest CAD programs available for the QL.



Left: Wireframe in VIEW mode.

co-ordinate. Cursor incrementing can also be defined by calling the environment menu and inputting the required cursor step.

Toggled scaling

Co-ordinates in a drawing may be defined in one of three ways; Cartesian, wherein the co-ordinate system works as a displacement along the horizontal axis from the x value origin, followed by a displacement along the vertical axis for the Y origin value, with the default being the current position; Vector, wherein movement in distance, followed by an angle, clockwise in degrees from the vertical, with the default of 0,0; Relative, wherein movement is followed by an anti-clockwise angle, in degrees from the current position, with the default of 0,0.

CADette drawing dimensions may be

made from the its Plot utility, available from the CADette front-end.

The Talent Plus *3D Designer* provides a number of useful features. Although it is limited to wireframe only, simplicity of use seems to be the main objective. Designer screen will be in one of three states:

ROTATION, in which the current viewing position may be rotated about the azimuth and elevation directions of the drawing in any combination.

DESIGN, the mode in which all drawing occurs. This mode is indicated by the presence of the x, y and z co-ordinates in the upper left corner of the screen.

MENU, 17 main commands, some of which have associated sub-menus, available when the screen is in DESIGN mode.

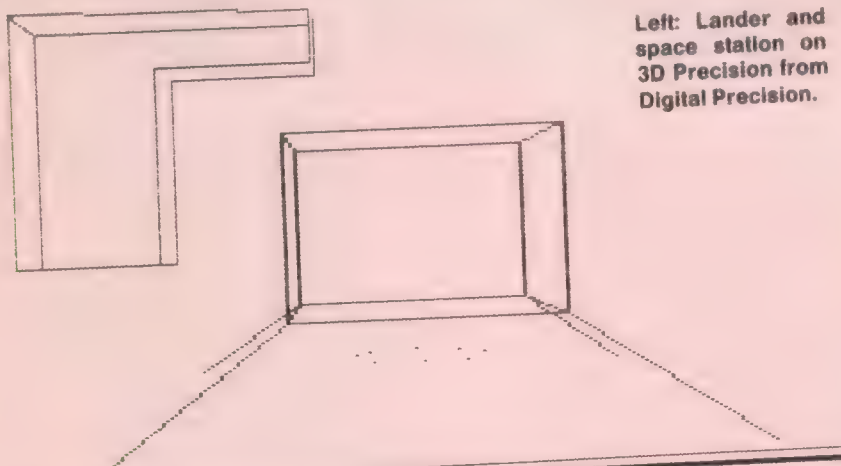
Navigation occurs by use of the cursor key and the space bar. Movement along

a wide range of applications. Additional files will allow you to set up program defaults for the display system you use, whether a colour or monochrome monitor or a television, defaulting to mode 4 or 8; Basic and assembler listings and demonstrations show you how to use drawings from your own Basic or machine code routines.

Object editor

The object editor forms the basis for a very flexible means of developing complex inter-related drawings. Forty-eight keys are assigned to perform particular functions in the program but, if required, any of all of the keys may be re-defined either temporarily or permanently to satisfy your requirements.

Care must be taken to ensure that



Left: Lander and space station on 3D Precision from Digital Precision.

altering any of the character codes does not cause a conflict with other functions. Keys representing CHR\$ codes 10 (enter), 27 (escape), 32 (space) and 192 (left cursor) to 248 (F5) are supplied as default control keys but there is no reason why any of the alphanumeric keys could not be used to employ mnemonic command entry.

The main screen consists of four windows, two on the left side of the screen for Help and the command menus; at the bottom of the screen, for status and program information and the larger drawing area. Facilities have been included to allow you to toggle between the default multi-window layout to full-screen drawing area.

Active commands in the current menu are highlighted with a menu bar; pressing <F4>/<F5> moves the bar up and down respectively; pressing <SPACE> or <ENTER> selects the highlighted command. The cursor may be set in one of four modes.

One of the most impressive features of 3D Precision as a working system is the inherent adaptability of program output. Once you have completed one or more

drawings, you can use the toolkit consisting of 80 SuperBasic extensions to manipulate your drawings from either SuperBasic or, by using the machine code version, machine code programs.

Perhaps one of the most impressive features common to all the programs featured in this survey is that all require little or no computing experience. What is required is a predisposition towards organised thinking and a strong inclination for forward planning.

Each of the programs detailed has its own features to commend it. If you are drawing plans of an object which eventually will be built from the drawings you produce, a two-dimensional CAD program will probably be the only type which will be of much use to you.

QL CADette is very impressive, particularly when one considers that it will

run in a standard 128K machine. To confine the program to a standard QL, the author had to restrict the number of relatively less important features available to the user. One of the compromises is that there is no facility for producing a directory of drawing files.

Bestmalt is developing two extensions to the system which will provide potential users with the tools to incorporate a full CAD workstation into drawing systems. One is an expanded version of CADette, which is scheduled for release in the foreseeable future and will take full advantage of extra memory.

Process drawings

The other product, in the form of a toolkit, will allow programmers to use CADette to process drawings generated by their programs.

Drawing with Designer is particularly simple and is readily-suited to working freehand. The comment structure is such that you toggle between drawing and viewing modes by pressing <ENTER>. The only difficulty you may encounter is that, if you rotate your developing image

in particular combinations of x, y and z axes, it is possible to position a drawing in such a way that the cursor can move in a single direction, regardless of the key used.

Although not so outwardly sophisticated as the other two programs, Designer has an appeal its own and although its user interface is about as simple as it is possible to be, it is a very useful tool.

Image D has its greatest strength in that it compels the user to work in a planned and structured way. One of its curious omissions is that clearing the screen — and work area — of a drawing requires you virtually to re-start the program.

In 3D Precision, Digital Precision has managed to assemble in a single package one of the most comprehensive visualising programs available. Of particular interest to those wishing to use their drawings outside the program environment, a particularly powerful graphic toolkit of drawing commands is supplied with the "kit" which, with a minimal amount of SuperBasic or, if you are into assembler, machine code, you can produce near-animation-quality sequences for use in lectures, educational applications or for fun. In this one respect, Precision is not unlike another DP product, *Super Sprite Generator*.

The sole area where I felt 3D Precision could be improved is its screen layout. Using mode 8 CSIZE 0,0 (mode 4 CSIZE 2,0) gives the screen a slightly overcrowded appearance. I would imagine that the reason for the character size used in the information was to make it compatible with any viewing medium users are likely to have available — colour or monochrome monitors or television sets.

Program: QL CADette **Price:** £25
Source: Bestmalt Ltd, Nantyregrlwy, Llanboidy, Whitland, Dyfed SA34 0DL. Tel.: 09946 370.

Program: 3D Designer **Price:** £38
Source: Talent Plus, Stone Street, North Stanford, Ashford, Kent TN25 6DF.

Program: Image D **Price:** £24
Source: PDQL Computer Systems and Software, Unit 1, Heaton House, Camden Street, Birmingham B1 3BZ. Tel.: 021 200 2313.

Program: 3D Precision **Price:** £49.95
Source: Digital Precision, 222 The Avenue, London E4 9SE. Tel.: 01 527 5493.

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If you have a program worthy of consideration, send it to 'The Progs',
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Program of the month

'Ftidy' —

A file sorting utility using Unix type directory structures by Howard Class.

This program enables the user to view a complete directory of filenames while making decisions, rather than popping them up one at a time. It can easily handle discs with several hundred files on them. Screen and character sizes are adjusted automatically to monitor TV output on both sides of the Atlantic and the files are listed in alphabetical order. You cannot do anything irrevocable without confirmation and there are View and All-Except options. Since files are copied serially, it is slower than *Fcopy* for Microdrives and there should be no significant speed difference for use with discs.

The simplest filenames consist of two parts, the device name and the file name, for instance mdv1—boot. The Psion suite also adds three-letter extensions indicating the kind of file, for example —bas for a Basic program. Discs hold so many files that an extra extension is desirable, for example mdv1—dirname—boot—bas.

This means that you can group related files in the same directory. This program allows you to set up directories, list and

manipulate files in them, without having to type the directory name more than once. You can use sub-directories so long as the QL absolute limit of 36 characters is not exceeded. Unfortunately you cannot use directories with the Psion suite except for storing back-ups.

After the windows are set up you are presented with the default source directory name. To accept, press ENTER. To change it, type in your choice of name, with a maximum of 18 characters, which will overwrite the default. The first five characters must be an acceptable device name — all three letters in the same case — followed by an underscore or 'x'. After that, if you know what directory you want, enter it with a terminal underscore or leave the device name to view all files.

Fplxscratch

The 'x' option allows you to reverse the foregoing process and list all files except the ones in your selected directory. Replace the — after the device name with x; for instance, fplxscratch— lists all the files on flpl which are not in the directory 'scratch'.

The File List in obtained

by sorting through the designated device directory and choosing or rejecting any files which begin with your directory name, sorts them into alphabetical order — upper-case has precedence over lower-case — and prints as much as possible of each filename on to the screen. If you are using a monitor and there are about 200 files in your directory — or a TV with 120 files — you will get only the first three letters of each but if there are 12 you could get all 36 characters. You can also get a list of all files beginning with, for example, an 'a'.

If you are not concerned about alphabetical order, press ESC to get files in disorder, but more quickly. If you are already pressing ESC when the sorting message appears you should get the list in the order on the disc; otherwise it will be partly sorted.

The Target Directory is defined in the same way as the source without the x option. Even if you are not intending to copy files you must tell it something or accept the default.

The Main Menu now appears. The flashing header will draw your attention to it. You must select some files (F2) before you can do anything else

except change directories.

F1 allows you to change the directories. You are first asked whether you want to change the course directory; otherwise the target can be changed alone, without affecting the list of selected files.

Selects files

F2 selects files from the list. You can select all, some, or all-except. If you choose S, the files are copied in the order in which you select them, otherwise in the order on the screen. Once selected, files are highlighted in green. You can do several operations with the same selection.

F3 copies selected files from source to target, with the option of formatting the target device. You can use this to copy files from one directory to another on the same device but do not format it first. If you are using a non-dynamic RAMdisc and want to format it, type-in the number of sectors when you are asked for the name. When you make multiple copies the ink colour of your selected files toggles between white and black so that you can see what is happening.

F4 deletes the selected files from the source device.


```

5 CLEAR:nm$. 'Ftidy'
10 REMark A File Sorting Utility using
15 REMark Unix type directory structures.
20 REMark ©1988 h. j. clase
25 REMark Version 1.33 1988.05.13
30 REMark Based on an idea by Paolo Baccanello
35 REMark QL USER February 1985
40 Initialise
100 REMark ~~~~~ Main
105 REPEAT menu
110 quay = CODE(INKEY$(0))
115 SELECT ON quay
120 =232: Ch_dir Confirm(prt$(8))
125 =240: Copy_files: =244 : Delete files
130 =248: Run_file: =236 : Sel_files
135 =250: Relist: F keys
140 =81,113:
145 IF Confirm(" Quit?"&prt$(9)): EXIT menu
150 END SELECT
155 IF count<9
160 ky$="Press F1-F5": IF mon: ky$-ky$&" /Q"
165 CURSOR#7,12*mon,5: INK#7,6: PRINT#7,ky$:
170 ELSE IF sel_max: CLS#8
175 CLS#7,3: END IF
180 count=count+1: IF count=17: count=0
185 END REPEAT menu
190 Restore_windows: STOP
200 REMark ~~~~~ Initialise
205 DEFINE PROCEDURE Initialise
210 LOCAL i: DIM p(15): count = 0
215 posdev$="MDV\FLP\FDK\RAM"
220 DIM prt$(12,18): temp$="": wipe = 1
225 RESTORE 605: FOR i = 1 TO 12: READ prt$(i)
230 READ overwrite
235 d=PEEK(163890)
240 IF d=0: Set_up_MON: ELSE Set_up_TV
245 MODE 4: OPEN#5,scr : OPEN#6,con
250 PAPER#5,0: WINDOW#5,512,256,0,0:CLS#5
255 OPEN#7,scr : OPEN#8,con : Windows
260 DIM content$(absmax+2,36)
265 Ch_dir 1: F keys: END DEFINE
300 REMark ~~~~~ Windows
305 DEFINE PROCEDURE Windows
310 WINDOW#5,p(0),p(1),p(2),p(3): PAPER#5,0
315 WINDOW#6,p(4),p(5),p(6),p(7): PAPER #6,6
320 WINDOW#7,p(8),p(9),p(10),p(11): PAPER #7,5
325 WINDOW#8,p(12),p(13),p(14),p(15): PAPER #8,6
330 WINDOW#0,p(12),p(13),p(14),p(15): PAPER #0,0
335 BORDER#7,d<2,4: BORDER#8,3+mon,6: BORDER#6,1,6
340 BORDER#5,2,4: BORDER#0,3+mon,6
345 FOR i = 5 TO 8: CLS#i
350 END DEFINE
400 REMark ~~~~~ Set_up_TV
405 DEFINE PROCEDURE Set_up_TV
410 mon=0: tv=1: absmax=126
415 rows=14: bigchs=37: smchs=56: switch=rows*5
420 IF d=2: RESTORE 655: ELSE RESTORE 665
425 FOR i=0TO 15: READ p(i)
430 RESTORE 685: FOR i = 1 TO 5: READ prt$(i)
435 END DEFINE
500 REMark ~~~~~ Set_up_MON
505 DEFINE PROCEDURE Set_up_MON
510 mon=1: tv=0: absmax=210
515 rows=15: bigchs=63: smchs=84: switch=rows*7
520 RESTORE 675: FOR i=0TO 15: READ p(i)
525 END DEFINE

```

Continued overleaf ►

The ink colour fades as they are deleted. You cannot recover them with this program. F5 allows you to view the first few lines of each file. Psion files are readable but not properly formatted; machine code looks peculiar.

You can also LRUN, EXEC, or EXEC-W the first file on the selected list. LRUN over-writes Ftidy, of course, but to continue with Ftidy after the other two, press CTRL F.

Q is for Quit, leaving you with your original windows. The program is still there and can be re-RUN.

The program uses the bottom right window to communicate. If nothing appears to be happening, look down — it may be asking you a question. If there is no cursor, press one of the designated keys; if it is flashing, press ENTER after your entry.

Directory window

The full filename, so far as the storage device is concerned, will be what appears in the Current Directory window followed by the rest of the name as it appears in the list, except for the 'x' options.

The program generally

accepts input in either case but it will throw out device names in mixed cases; for example, 'Flp' is not acceptable. This does not apply to directory names: fred—, FRED—, and even frED are all equivalent.

Although you cannot display more than 210 — 126 TV — names at once, this is per directory, not per disc. If you exceed this limit you will get a beep and have to re-enter from a more restricted source. If, at this point, you do not know any directory names, or there are none, I suggest the following strategy. Try a source directory with one letter after the device name, for example flpl—q. This will give you a list of all files on the disc beginning with q. If there is a fair amount of room on your original device use a target directory like flpl—temp—q; otherwise use a different device name such as raml—temp—q. Copy the files, delete the originals and remember to copy them back if you are using an intermediate device.

If necessary, repeat this with a few other letters and you will soon have enough of your files in temp— to be able to list all the remaining files using flplxtemp— as your source. It is possible

that you will have to set up two temporary directories if you are using a TV or have a very full disc. Once all the files are listable in this way you can organise them into meaningful directories.

Users may want to change some aspects to suit their systems. They are gathered in the first few procedures, and discussed in line order.

215 "posdev\$" — possible devices: if you have other devices, add them to the string. NET and SER are possible candidates.

410//510 "absmax" sets the number of files the program can handle in one go. The default values will give at least three letters of each filename; if you want more files and can cope with fewer letters, use the following table to find appropriate values:

Minimum no. of letters	3	2	1
Monitor (510)	210	240	315
TV (410)	126	154	196

415/515 "switch" determines the number of columns at which the size of characters on the screen

changes to allow more characters to be seen. If you have a poor TV screen and cannot see CSIZE 1,0 you may want to raise this but you will see fewer letters of each name. Monitor users may want to go the other way.

630, the initial defaults for Source and Target. Change them to suit your favourite devices or directories.

640, if you have a RAMdisc, use it here. It must be formatted first. If you include a format statement in the program, remember that it will clear out anything already in the RAMdisc. I use FORMAT RAM7-10 at line 210 and do not use RAM7 for any other purpose.

From time to time I type in machine code programs as Basic DATA statements, and find it frustrating, as

checksums often are not provided and, even when they are, it is not easy to pinpoint typing errors.

```

600 REMark .....DATA
605 DATA "Change Dirs", "Select Files", "Copy Files"
610 DATA "Delete Files", "View/Run/Exc"
615 DATA "Source", "Target"
620 DATA "      Change source?", " Are you sure?"
625 REMark default devices & directories
630 DATA "FLP1_" "FLP2_"
635 REMark Device for temporary file.
640 DATA "FLP1_": REMark ram#i is best
645 DATA 1: REMark Overwrite flag for Copy_files
650 REMark Window data:-
655 DATA 456,126,28,0,304,42,180,128: REMark NTSC
660 DATA 148,86,28,129,304,22,180,172
665 DATA 456,156,28,16,304,52,180,174: REMark PAL
670 DATA 148, 82,28,174,304,26,180,228
675 DATA 512,166,0,4,310,52,202,172: REMark Mon
680 DATA 198, 84, 0,172,310,30,202,228
685 DATA "Change", "Select", "Copy", "Delete"
690 DATA "View/Run"
700 REMark .....Directory
705 DEFINE PROCEDURE
710 LOCAL index: CLS#5 :STRIP#5,0
715 FOR index = 1 TO max_no:Scr_pos index,4
720 END DEFINE
800 REMark .....Get_dir
805 DEFINE PROCEDURE
810 LOCAL name$,file$,too_many,$: too_many=0
815 z$="zzz": file$ = prt$(12)&z$: CLS#5
820 Prt "Picking out files.",5,2,0,10+mon,5,4,1
825 DELETE file$: OPEN_NEW #9,file$
830 DIR#9,source$(1TO 5): CLOSE#9: OPEN_IN#9,file$
835 FOR file = 1,2: INPUT#9,content$(file)
840 file=3: Pick_out_names
845 CLOSE#9: DELETE file$
850 IF NOT too_many
855   max_no = file-1: Organise_output
860   DIM files(max_no): sel_max=0: copy_ink=6
865   ELSE : CLS#5:t$="Too many files in "&source$
870   Prt t$,5,2,0,3+mon,5,4,1: Bepe
875   wipe = 0: files_ok = 0
880 END IF
885 END DEFINE
900 REMark .....Pick_out_names
905 DEFINE PROCEDURE
910 LOCAL l,lp
915 REPEAT lp
920   IF EOF(#9): EXIT lp
925   INPUT #9,name$: l=LEN(name$)
930   IF file>absmax+2
935     IF NOT (name$==z$ AND EOF(#9)): too_many=1
940     EXIT lp
945   END IF
950   Ttest name$.1
955   END REPEAT lp
960   END DEFINE
1000 REMark .....Ttest (n$,1)
1005 DEFINE PROCEDURE
1010 LOCAL d,e: e=1
1015   IF excl
1020     IF NOT n$(1 TO sdl)==sdir$
1025       content$(file)=n$
1030     IF NOT content$(file)==z$: file=file+1
1035   END IF
1040   ELSE
1045     IF xl
1050       IF xl <= 1
1055         e = n$(1-xl+1 TO 1)==ext$
1060       ELSE e = 0
1065     END IF : END IF
1070     d = name$(1TO sdl)==sdir$
1075     IF d AND e
1080       content$(file)=name$(sdl+1 TO 1)
1085       IF NOT content$(file)==z$: file=file+1
1090     END IF : END IF
1095   END DEFINE
1200 REMark .....Organise output
1205 DEFINE PROCEDURE
1210 IF max_no>2
1215   IF max_no<=switch
1220     chars=bigchs: siz=1+tv
1225   ELSE chars=sachs: siz=0+tv
1230   END IF
1235   IF max_no-2 > rows
1240     col_width=INT(chars/(1+(max_no-3)DIV rows))
1245   ELSE : col_width = 36: END IF
1250   Shellsort content$(2TO max_no): Directory
1255   ELSE : t$="No files in "&source$
1260   CLS#5: Prt t$,5,2,0,6,5,4,1: Bepe
1265   wipe = 0: files ok = 0
1270 END IF
1275 END DEFINE
1300 REMark .....

```

```

1305 DEFINE PROCEDURE Prt (m$,c,w,h,x,y,i,p)
1310 LOCAL k$
1315 INK#c,i: CSIZE#c,w,h: AT#c,y,x: PRINT#c,m$;
1320 IF p<>1
1325   IF p=2
1330     AT#c,y,x+7: k$=INKEY$(#c,-1)
1335     IF k$=CHR$(10)
1340       temp$=""
1345     ELSE CLS#c,4: PRINT#c,k$:
1350       INPUT#c,temp$: temp$=k$&temp$
1355     END IF
1360     ELSE INPUT#c;temp$:END IF
1365 END IF :END DEFINE
1400 REMark .....F keys
1405 DEFINE PROCEDURE
1410 LOCAL f,f$: f$=""
1415 FOR f=1 TO 5
1420   Prt "F"&f&f&prt$(f),7,2,0,0,f+1,1,1
1425 END FOR f
1430 Prt " Q"&f&f&"Quit",7,2,0,0,7,1,1
1435 END DEFINE
1500 REMark .....Ch_dir(flag)
1505 DEFINE PROCEDURE
1510 LOCAL l,lp,files_ok: CLS#8
1515 IF flag
1520   REPEAT lp
1525     CLS#6: files_ok=1: IF wipe: CLS#5
1530     Prt "Current Directories",6,2,1,3,0,3,1
1535     Dir_name 1: wipe = 1: l=LEN(prt$(10))
1540     IF l>5
1545       Dismember(prt$(10))
1550     ELSE sdir$="": sdl=0: ext$="": xl=0
1555     END IF
1560     IF excl
1565       prt$(10)=prt$(10,1TO 5): source$=prt$(10)
1570     ELSE source$=prt$(10,1TO 1-xl): END IF
1575     Get_dir: IF files_ok: EXIT lp
1580   END REPEAT lp: END IF
1585   Dir_name 2: target$ = prt$(11)
1590 END DEFINE
1600 REMark .....Dismember(p$)
1605 DEFINE PROCEDURE
1610 LOCAL p
1615 p=" "INSTR(p$)
1620 IF p
1625   ext$=p$(p+1 TO 1): xl=LEN(ext$)
1630 ELSE p=1: xl=0: END IF
1635 IF p$(6)="" : sdir$="": ELSE sdir$=p$(6TO p)
1640 sdl=LEN(sdir$)
1645 END DEFINE
1700 REMark .....Dir_name (f)
1705 DEFINE PROCEDURE
1710 LOCAL lp,m$,x$: excl=0: x$=""
1715 REPEAT lp
1720   CSIZE#6,2,0: AT#6,f+1,0: CLS#6,3
1725   m$="ENTER to accept default "
1730   m$=m$&" or type in new name."
1735   Prt m$,8,2,0,0,0,0,1
1740   Prt prt$(f+5)&" "&prt$(f+9),6,2,0,0,f+1,3,2
1745   IF temp$="" :EXIT lp
1750   IF LEN(temp$)>4 AND LEN(temp$)<19
1755     IF temp$(1TO 3) INSTR posdev$
1760       x$=temp$(5): IF x$ INSTR "_/X"
1765       prt$(f+9)=temp$
1770       AT#6,f+1,6:CLS#6,4
1775       Prt prt$(f+9),6,2,0,7,f+1,3,1:EXIT lp
1780     END IF : END IF : END IF : Bepe
1785 END REPEAT lp: CLS#8
1790 IF x$=""x': prt$(f+9,5)="_": IF f=1: excl=1
1795 END DEFINE
1900 REMark .....Sel_files
1905 DEFINE PROCEDURE
1910 LOCAL i,lp,k$: copy_ink = #
1915 IF sel_max
1920   STRIP#5,0
1925   FOR i=1 TO sel_max:Scr_pos files(i),4
1930   END IF
1935   STRIP#5,4: CLS#8
1940   DIM files(max_no - 2): sel_max= 0
1945   Prt "All, Some, or eXclude?",8,2,0,1,0,2,1
1950   Prt "(A/S/X)",8,2,0,8,1,2,1
1955   REPEAT lp
1960     k$=INKEY$(#8,-1)
1965     IF k$ INSTR "S\A\X": EXIT lp
1970     Bepe: END REPEAT lp
1975     IF k$=""s': Slect : ELSE All_eX
1980   END DEFINE
2000 REMark .....Slect
2005 DEFINE PROCEDURE
2010 LOCAL ch$,p$,t: ch$="" : CLS#8
2015   p$="Selected file # or "END"
2020   Prt p$,8,2,0,0,0,2,1

```

```

2025 REPEAT lp
2030 AT#8,1,0: CLS#8,3: Prt'',8,2,0,8,1,2,0
2035 IF temp$=="END" OR sel_max = (max_no -2)
2040 EXIT lp: END IF
2045 IF temp$<>' ' AND temp$<>'0'
2050 t= NOT ("*"&temp$&"* INSTR ch$)
2055 IF t AND Chk_num(temp$)
2060 IF temp$+1 < max_no
2065 sel_max = sel_max+1: ch$ = ch$&temp$&'*'
2070 files(sel_max) = temp$+2
2075 Scr_pos files(sel_max),0
2080 ELSE Bepe: END IF : ELSE Bepe: END IF
2085 ELSE Bepe: END IF
2090 END REPEAT lp: END DEFINE
2100 REMark ~~~~~
2105 DEFINE PROCEDURE All_eX
2110 LOCAL i,ex$(max_no),p$: sel_max = 0
2115 IF k$=="x'
2120 STRIP#5,2: i = max_no-2
2125 REPEAT lp
2130 p$='Excluded file # or "END": CLS#8
2135 Prt p$,8,2,0,0,0,2,1:Prt'',8,2,0,10,1,2,0
2140 IF temp$=="END" OR i=0: STRIP#5,4: EXIT lp
2145 IF temp$<>' ' AND temp$<>'0'
2150 IF Chk_num(temp$)
2155 IF temp$+1 < max_no
2160 f = temp$+2
2165 IF ex$(f)=0: ex$(f)=1:i=i-1:Scr_pos f,4
2170 ELSE Bepe: END IF :ELSE Bepe: END IF
2175 ELSE Bepe: END IF
2180 END REPEAT lp:END IF
2185 FOR i = 3 TO max_no
2190 IF ex$(i) = 0
2195 sel_max = sel_max + 1: files(sel_max) = i
2200 Scr_pos i,0
2205 ELSE : STRIP#5,0: Scr_pos i,4: STRIP#5,4
2210 END IF : END FOR i
2215 END DEFINE
2300 REMark ~~~~~
2305 DEFINE FUNCTION Chk_num (str$)
2310 LOCAL val
2315 FOR test = 1 TO LEN (str$)
2320 val = str$(test) INSTR "1234567890"
2325 IF NOT val: EXIT test
2330 END FOR test
2335 RETURN val
2340 END DEFINE
2400 REMark ~~~~~
2405 DEFINE PROCEDURE Bepe
2410 BEEP 4000,25
2415 END DEFINE
2500 REMark ~~~~~
2505 DEFINE PROCEDURE Scr_pos (n,ik)
2510 LOCAL space,sp$
2515 IF n<3
2520 x = 5*mon+17*(mon+1)*(n-1): y = 0
2525 space = 19: ik = 8
2530 ELSE space = col_width
2535 y = 1+(n-3) MOD rows
2540 x=space*((n-3) DIV rows)
2545 Prt n-2,5,siz,0,x,y,8,1
2550 END IF
2555 sp$ = content$(n,1 TO space-3): OVER#5,0
2560 Prt sp$,5,siz,0,(x+2+(n>101)),y,ik,1:OVER#5,1
2565 AT#5,0,0: END DEFINE
2600 REMark ~~~~~
2605 DEFINE PROCEDURE Run file
2610 LOCAL f$,k,k$,lp: CLS#8: k=KEYROW(8)
2615 IF sel_max
2620 REPEAT lp
2625 Prt"View, Run, or Exec(W)?",8,2,0,0,0,0,1
2630 Prt"(V/R/E/W)",8,2,0,7,1,0,1
2635 k$=INKEY$(#8,-1)
2640 IF k$ INSTR "VREW": EXIT lp
2645 Bepe: END REPEAT lp
2650 IF k$=="v'
2655 Vue
2660 ELSE : f$ = source$&content$(files(1))
2665 IF k$=="R": LRUN f$
2670 IF k$=="E": EXEC f$: ELSE EXEC W f$
2675 REPEAT lp: IF CODE(INKEY$(0))=6: EXIT lp
2680 Windows: Relist: F keys
2685 END IF : ELSE : No file: END IF : END DEFINE
2700 REMark ~~~~~
2705 DEFINE PROCEDURE No file
2710 Bepe: CLS#8
2715 Prt "No file Selected",8,2,0,3,0,0,1
2720 END DEFINE
2800 REMark ~~~~~
2805 DEFINE PROCEDURE Copy_files
2810 LOCAL i,n,esc$,n$,p$: esc$ = CHR$(27)
2815 IF sel_max

```

```

2820 Ask_format
2825 p$ = 'Hold "ESC" to interrupt'
2830 Prt p$,8,2,0,0,0,0,1
2835 FOR i = 1 TO sel_max
2840 IF INKEY$(0) = esc$: EXIT i
2845 n = files(i): n$ = content$(n)
2850 Scr_pos n,copy_ink
2855 IF overwrite: DELETE target$&n$
2860 COPY source$&n$ TO target$&n$
2865 END FOR i
2870 copy_ink = 6*(NOT copy_ink)
2875 ELSE : No file: END IF
2880 END DEFINE
2900 REMark ~~~~~
2905 DEFINE PROCEDURE Delete files
2910 LOCAL loop
2915 IF sel_max
2920 IF Confirm (" Delete?"&prt$(9))
2925 STRIP#5,0
2930 FOR loop = 1 TO sel_max
2935 current = files(loop)
2940 Scr_pos current,2
2945 DELETE source$&content$(current)
2950 END FOR loop
2955 wipe = 0: Ch dir 1
2960 END IF
2965 ELSE : No file: END IF
2970 END DEFINE
3000 REMark ~~~~~
3005 DEFINE PROCEDURE Ask_format
3010 LOCAL p$
3015 p$ = " Format "&target$(1 TO 5)&"?"
3020 IF Confirm(p$)
3025 IF Confirm(" &prt$(9))
3030 Prt "Drive Name? ",8,2,0,0,0,2,0
3035 AT#8,1,3: FORMAT#8,target$(1 TO 5)&temp$
3040 END IF :END IF
3045 END DEFINE
3100 REMark ~~~~~
3105 DEFINE FUNCTION Confirm (m$)
3110 LOCAL t$: CLS#8: Prt m$,8,2,0,0,0,0,1
3115 Prt"(Y/N)",8,2,0,9,1,0,1
3120 REPEAT wait
3125 t$= INKEY$(#8,-1)
3130 IF t$ INSTR "YN": EXIT wait
3135 Bepe: END REPEAT wait
3140 CLS#8: IF t$=="y":RETURN 1: ELSE RETURN 0
3145 END DEFINE
3200 REMark ~~~~~
3205 DEFINE PROCEDURE Shellsort (a$)
3210 LOCAL g,i,j,k,n,t$,w$
3215 n=DIMN(a$): g=INT(n/2): CLS#5
3220 t$ = "Sorting files into alphabetical"
3225 Prt t$,5,2,0,3+mon*2,5,4,1
3230 t$ = "order. Press ESC to abort sort."
3235 Prt t$,5,2,0,2+mon*2,7,4,1
3240 REPEAT sort
3245 IF CODE(INKEY$(0))=27: EXIT sort
3250 FOR i=1TO n-g
3255 FOR j=i TO 1 STEP -g
3260 k=j+g
3265 IF a$(j)>a$(k)
3270 w$=a$(j): a$(j)=a$(k): a$(k)=w$
3275 ELSE j=1: END IF
3280 END FOR j: END FOR i
3285 g=INT(g/2): IF g=0: EXIT sort
3290 END REPEAT sort :END DEFINE Shellsort
3300 REMark ~~~~~
3305 DEFINE PROCEDURE Vue
3310 LOCAL df,i,j,k,k$,l$,n$,t$: l$=CHR$(10): df=0
3315 IF sel_max
3320 FOR i = 1 TO sel_max
3325 n$=content$(files(i)): CLS#5
3330 Prt n$,5,siz,0,0,0,6,1: PRINT#5: INK#5.4
3335 OPEN IN#9.source$&n$
3340 FOR j=1TO rows
3345 FOR k=1TO chars
3350 IF EOF(#9): EXIT k: EXIT j
3355 k$=INKEY$(#9,-1): IF k$=l$: EXIT k
3360 PRINT#5,k$:; END FOR k
3365 IF k$=l$: PRINT#5
3370 END FOR j: CLOSE#9
3375 IF One off: EXIT i
3380 END FOR i: IF df: Ch dir 1: ELSE Relist
3385 ELSE : No file: END IF
3390 END DEFINE
3400 REMark ~~~~~
3405 DEFINE FUNCTION One_off
3410 LOCAL m$,q,t,t$,wait: q=0: CLS#8
3415 m$='Next, Copy, Delete, Quit'
3420 Prt m$,8,2,0,0,0,0,1
3425 Prt '(N/C/D/Q)',8,2,0,7,1,0,1

```



```

3430 REPeat wait
3435 t$ = INKEY$(-1)
3440 t = t$ INSTR 'NCDQ':IF t: EXIT wait
3445 Bepe: END REPeat wait
3450 SELEct ON t
3455 = 2: IF overwriTe: DELETE target&n$
3460 COPY source&n$,target&n$
3465 = 3: IF ConfirM(' Delete?')&prt$(9))
3470 DELETE source&n$: df = 1: END IF
3475 = 4: q = 1
3480 END SELEct
3485 REturn q: END DEFINE
3500 REMark
3505 DEFINE PROCEDURE
3510 LOCAL i: Directory: STRIP#5,4: copy_ink = 6
3515 FOR i=1TO sel_max: Scr_pos files(i),0
3520 FOR i=1,2
3525 Prt prt$(i+5)&' '&prt$(i+9),6,2,0,0,i+1,2,1
3530 END FOR i: END DEFINE
3600 REMark
3605 DEFINE PROCEDURE
3610 WINDOW#5,512,256,0,0: PAPER#5,0: CLS#5
3615 FOR i=5TO 8: CLOSE#i
3620 MODE 8*(NOT (NOT d))
3625 END DEFINE
3700 REMark

```

Data-maker

A program to create a file of BASIC DATA lines with checksums, directly from bytes in memory, by Howard Clase.

This program converts a section of memory directly into a file of Basic DATA statements. The file has the extension "-data". The first line contains the number of bytes and those following contain 10 bytes each, followed by a checksum for the line. The last line obviously will not always be 10 bytes but it still ends with a checksum.

I have tried it on many machine code programs and it has never generated lines of more than 50 characters, although it

could go to 54. Lines could also be shortened to nine bytes plus checksum. Data-maker is for use before the data is printed and since the lines are generated automatically, there is little likelihood of an error creeping in at this stage.

The latest version of Ftidy includes two major new features, the ability to select files with a particular extension and options to copy or delete while actually viewing a file.

```

10 nm$= "Data_maker"
20 REMark A program to create a file of
30 REMark BASIC DATA lines with checksums,
40 REMark directly from bytes in memory.
50 REMark Howard Clase 1987.03.24
100 REMark Main
105 UwindoWs : Start
110 Create_data (base),(num) : Finish
200 REMark Procedures
205 DEFINE PROCEDURE Start
210 LOCAL b$,n$
215 dev$='mdv1_': REMark Change as required <<<<
220 CURSOR 30,4: PRINT,"Enter" for defaults'
225 PRINT," Address of first byte?"
230 PRINT " (Default bottom of RESPR area.)"
235 INPUT,b$;
240 IF b$ = ""
245 base=RESPR(0): PRINT base;
250 ELSE base = b$: END IF
255 PRINT," Number of bytes?"
260 PRINT " (Default to top of RESPR area.)"

```

```

265 INPUT, n$;
270 IF n$ = ""
275 num = PEEK_L(163872)-base: PRINT num;
280 ELSE num = n$: END IF
285 PRINT," Name for data file? (_data ex-"
290 PRINT" tension will be added by program.)"
295 INPUT(' '&dev$); nm$
300 OPEN_NEW#4,dev&n$m&"_data"
305 END DEFINE
400 REMark Create_data (b,n)
405 DEFINE PROCEDURE
410 LOCAL a,i,m,q,s,z
415 m=1010 :q=0: STRIP 4: INK 0
420 PRINT#4,"1000 DATA ";num
425 AT 14,8:PRINT"Creating line "
430 REPeat loop
435 IF (n DIV 10): z=10:n=n-10: ELSE z=n: q=1
440 s=0: IF z=0 : EXIT loop
445 AT 14,22:PRINT m
450 PRINT#4,m;" DATA ";
455 FOR i=1TO z
460 a=PEEK(b): PRINT#4,a;" ";
465 b=b+1: s=s+a
470 END FOR i
475 PRINT#4,s: m=m+10: IF q: EXIT loop
480 END REPeat loop
485 END DEFINE
500 REMark Finish
505 DEFINE PROCEDURE
510 CLOSE#4: BEEP 5000,25: AT 14,2
515 PRINT ' '&dev&n$m&"_data file created. "
520 END DEFINE
600 REMark UwindoWs
605 DEFINE PROCEDURE
610 LOCAL i,y0,y1
615 WINDOW 512,256,0,0: PAPER 0: CLS
620 IF PEEK(163890)=2
625 y0=161: y1=0
630 ELSE y0=177: y1=16
635 END IF
640 WINDOW#0,448,30,32,y0: PAPER#0,2: INK#0,6
645 WINDOW#1,448,160,32,y1: PAPER 0: INK 4
650 WINDOW#2,300,160,32,y1: PAPER#2,4: INK#2,0
655 BORDER 1,4: FOR i=0,2,1: CLS#i: CSIZE#i,0,0
660 END DEFINE
700 REMark

```

Data-loader

A program to load bytes from BASIC data statements into RESPR area with error checking by Howard Clase.

```

10 nm$= "Data_loader"
20 REMark A program to load bytes from
30 REMark BASIC data statements into the
40 REMark RESPR area with error checking.
50 REMark Howard Clase 1987.03.29
100 REMark Main
105 UwindoWs : Get_name
110 IF n$<>"" : fnm$=n$: MERGE dev&fnm&"_data"
115 Start : Load_bytes (base),(num)
120 IF NOT er
125 Finish: STOP
130 ELSE Correct: LIST 1000 TO 1150: STOP
135 END IF
200 REMark Procedures
205 DEFINE PROCEDURE Get_name
210 dev$='mdv1_': REMark Change as required <<<<<<

```

This program MERGEs in the "-data" file from the previous program and loads it into memory, checking each line as it does so. If a checksum error is encountered, loading stops, but the rest of the lines are still checked and all lines containing errors are reported on-screen, so that the lines can be corrected using the EDIT

command. If loading is successful the user is given the option of SBYTEing the code for future LBYTEing.

If you were to adopt something along these lines then only the -data file would need to be printed; the loader could be printed from time to time and both made available through Microdrive Exchange. I would waive my right to

royalties after initial publication.

I have made the programs fairly user-friendly. This always involved a compromise between brevity and unambiguity. There are reasonable default values in Data-maker and routines to

avoid long periods when nothing appears to be happening. The odd-looking windows generated by the procedure "Uwindows" are to accommodate the mythical JSU machine owner with an NTSC television as the only means of output.

```

215 fnm$="data"
220 PRINT\ ' Name of _data file?'
225 PRINT\ ' The _data extension is assumed'
230 PRINT\ ' by the program.)'
235 PRINT\ ' Press "ENTER" if file already'
240 PRINT\ ' merged.'
245 AT 2,1: INPUT(dev$); n$
250 END DEFINE
300 REMark ~~~~~
305 DEFINE PROCEDURE Start
310 LOCAL b
315 RESTORE 905: READ num: REMark No. of bytes.
320 REMark RESPR takes memory in 512 byte blocks.
325 b = 512*((num-1)DIV 512+1): base=RESPR(b)
330 END DEFINE
400 REMark ~~~~~
405 DEFINE PROCEDURE Load_bytes (b,n)
410 LOCAL a(10),c,i,m,lp,q,s,z
415 er=0: q=0: m=1010
420 CLS#: AT#0,0,6
425 PRINT#0," Loading line ";m
430 REPEAT lp
435 IF n DIV 10: z=10: ELSE z=n: q=1
440 IF z=0: EXIT lp
445 DIM a(10): s=0: AT#0,0,20: PRINT#0,m
450 FOR i=1 TO z: READ a(i): s=s+a(i)
455 READ c: IF s<>c: Error_message m: er=1
460 IF NOT er: FOR i=0 TO 9: POKE b+i,a(i+1)
465 IF q: EXIT lp
470 m=m+10: b=b+10: n=n-10
475 END REPEAT lp
    
```

```

480 END DEFINE
500 REMark ~~~~~
505 DEFINE PROCEDURE Error_message (m)
510 IF NOT er
515 CLS: CLS#4: BEEP 9999,99
520 PRINT\ " Loading aborted!"
525 PRINT#4,"Check lines:""\
530 AT#0,0,6:PRINT#0,"Checking"
535 END IF
540 PRINT#4,m,
545 END DEFINE
600 REMark ~~~~~
605 DEFINE PROCEDURE Finish
610 LOCAL k$,lp
615 CLS: CLS#0: BEEP 5000,25
620 PRINT\ " "&fnm$&" loaded into RESPR area. "
625 PAPER 0: INK 4
630 PRINT\ " Do you want to save as code? (Y/N)!"
635 REPEAT lp
640 k$=INKEY$(-1): IF k$ INSTR ("YyNn"): EXIT lp
645 END REPEAT lp
650 IF k$="Y": SBYTES dev$&fnm$&"_code",base,num
655 END DEFINE
700 REMark ~~~~~
705 DEFINE PROCEDURE Correct
710 PRINT\ " Press any key, \" correct and re-run."
715 CLS#: PAUSE(-1)
720 END DEFINE
800 REMark ~~~~~
805 DEFINE PROCEDURE Uwindows
810 LOCAL i,y0,y1
815 WINDOW 512,256,0,0: PAPER 0: CLS
820 IF PEEK(163890)=2
825 y0=163: y1=0
830 ELSE y0=179: y1=16
835 END IF : OPEN#4,scr_
840 WINDOW#0,448,30,32,y0: PAPER#0,2: INK#0,6
845 WINDOW#1,448,162,32,y1: PAPER 0: INK 4
850 WINDOW#2,300,160,34,y1+1: PAPER#2,4: INK#2,0
855 WINDOW#4,144,160,335,y1+1: PAPER#4,2: INK#4,7
860 BORDER 1,4: FOR i=0,1: CLS#i
865 END DEFINE
1000 REMark ~~~~~
1010 REMark dummy
    
```

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- | | |
|--|---|
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|--|---|

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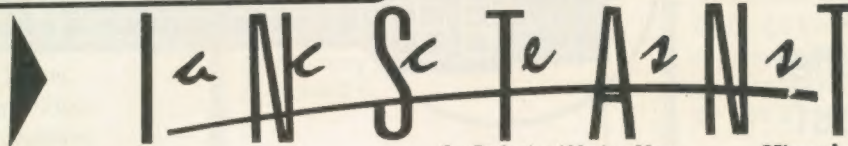
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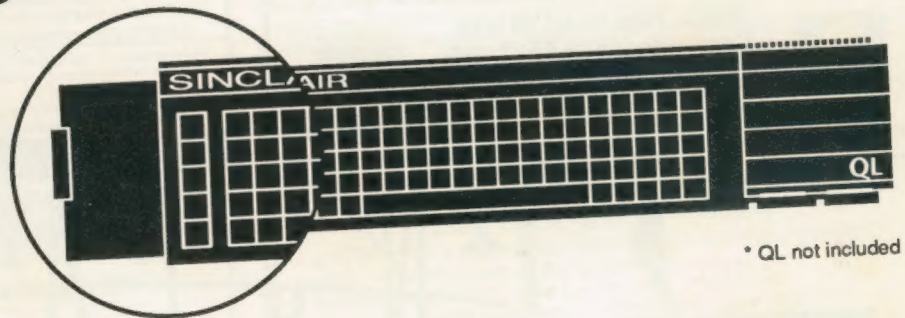
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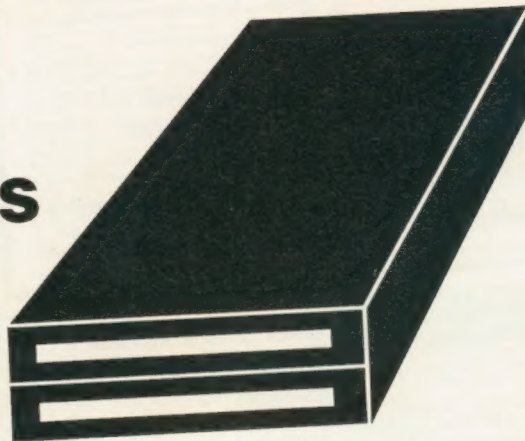
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